LAPP GROUP

# THE NEXT GENERATION OF ADVANCED ROBOTICS

Understanding new robotics trends so you don't fall behind.

WHITE PAPER

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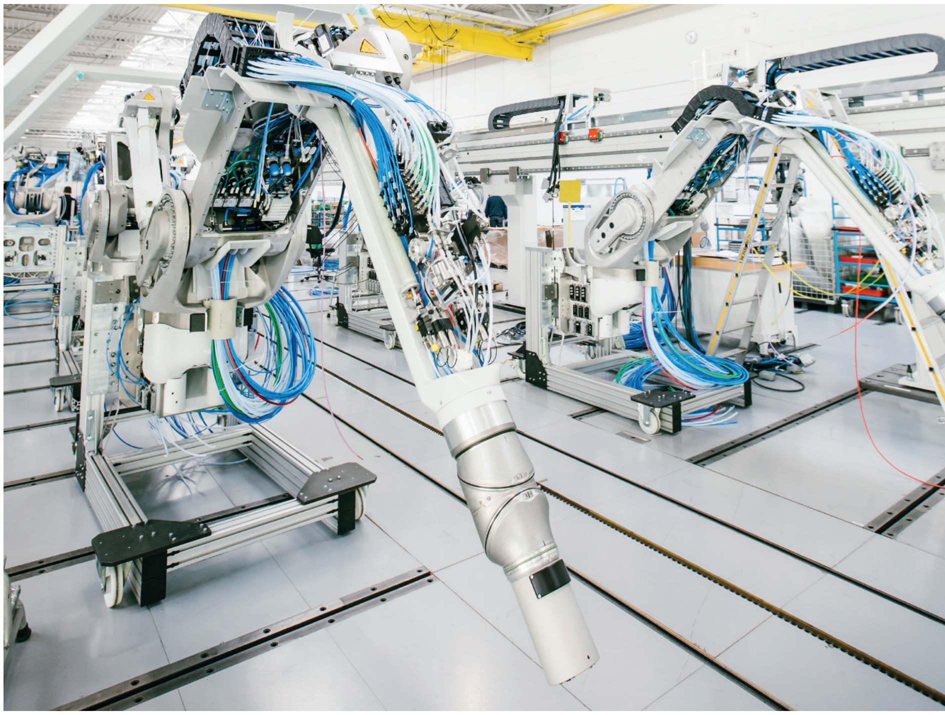
If you work with robots, you've noticed them getting faster, smaller for a given load capacity and more advanced in their overall capabilities. At the same time, today's robots have increasingly stringent uptime requirements.

But it's not just the robots that keep evolving. Components like cables and connectors must keep pace with today's advanced robotics technology. Without a reliable source for power and signal, even the sturdiest robots will fail.

In this paper, we'll show you new trends in advanced robotics, as well as some tips for properly specifying and installing cables into your robot.

**TOP TRENDS IN ROBOTICS TECHNOLOGY.**
Several trends are shaping today's robotics technology and helping expand its use beyond well-established automotive applications. In general, robots are becoming smaller, lighter, more nimble, easier to operate and less expensive. As robots become more lightweight and flexible, their mobility is also increasing. For example, six-axis robots are now commonly installed on platforms to move from one task to another. Cables must meet these new mobility demands, with companies such as Lapp offering plug-and-play solutions that connect robots to a so-called "seventh axis," which serves to move the robot into various positions. In this case, cable carriers with pre-installed cables are supplied by Lapp as complete units for ease of installation.



*A painting robot can switch from one shade of paint to another in 10 seconds with minimal waste.*

Further, with the trend toward lightweight robots, cables must become correspondingly lighter and more compact as well. Lapp is continuing to shave weight from cable installations by investigating new technologies such as foamed materials and thin jackets that protect the cable yet save weight at the same time. Although cables are becoming thinner and plastic jacketing more lightweight, power capacity remains the same with no loss in performance. Specialized plastics, copper-coated aluminum and various aluminum alloys are often used to achieve these weight savings, although copper is still considered the "go to" material when durability and compact cross sections are top design priorities.

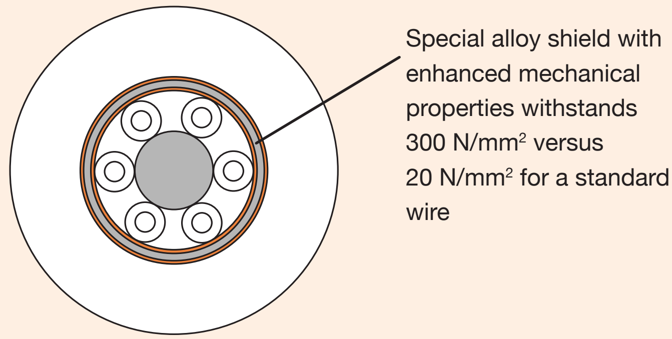
Another strategy that addresses both lightweighting and space-saving intiatives is to combine several functions into one component. For example, Lapp's ÖLFLEX® SERVO FD 7DSL combines data and power transmission lines into one cable, useful for minimizing the cable footprint and related mass in dynamic acceleration applications. Traditionally, two cables were used in this setting—one cable to supply power and another to transmit data regarding motor position and speed. With the hybrid cable solution, power and data are transferred over a common line and serve to maximize weight and space savings. In other cases, hybrid units combine even more functions—carrying control signals, power supply lines, and media lines for oil or compressed air within the same cable.

Yet another aspect of space savings in robotics applications involves the choice of interior or exterior cabling. For example, consider a large robotic work cell where 15 or more welding robots act together to assemble an automobile chassis. In this highly dynamic and space constrained production environment, exterior robotic cables are too bulky and cumbersome. Lapp works closely with robot suppliers to provide cables that run on the inside, saving space and minimizing hazards such as tangled lines and cables becoming dislodged during breakneck operating speeds.

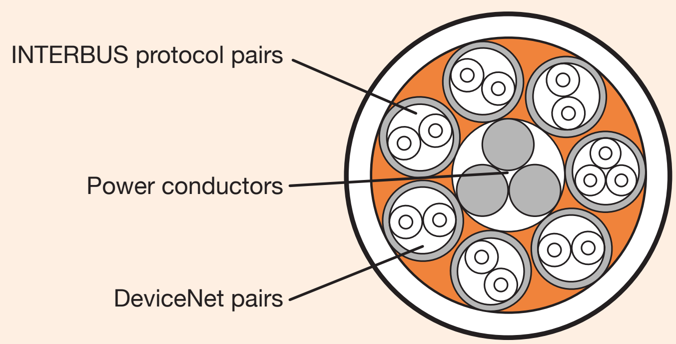
Because velocities and braking velocities of this magnitude are common in robotics applications, cables must be designed to match these speeds and motions. Cables must be as lightweight and flexible as possible to minimize the amount of mass that must be moved, in addition to withstanding the rigors of millions of bending and twisting cycles without failure. Be sure to ask your supplier about exact product specifications and whether or not cables are designed to handle bending and/or torsion loads. For example, Lapp offers the wear resistant ÖLFLEX® ROBOT F1, a TPE-PUR robot cable designed for simultaneous flexing and torsion loads in multi-axis articulated robots and automated handling equipment.

## ROBOTIC CABLE CHARACTERISTICS

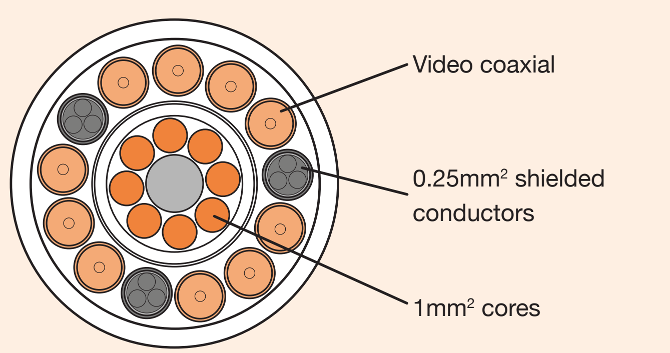
### Engineered For High Forces




### Supports Multiple Field Bus Protocols




### Carries Machine Vision Signals



Torsion-rated cables are specifically designed to withstand increased torsional stresses and feature a different construction than continuously flexing cables. Continuous flex cable conductors are wrapped tightly to allow relative movement of individual conductors, whereas robotic cables feature significantly longer lay lengths to compensate for more stressful torsional forces. In torsion applications, the following parameters must be considered: maximum speed and acceleration; minimum bending radii of cables and wires; combined weight of all moving components; and desired life expectancy of the complete system.

**TIPS FOR CORRECT SPECIFICATION AND INSTALLATION.**

- ***Consider the type of motion involved***—Due to time constraints, standard industrial cable is often selected as "good enough" without due consideration of the application environment. For example, the fast and repetitive motions involved in many robotics applications call for high-flex cables. If standard cables are selected instead, this will likely result in premature wear—especially for cables that supply power and data to end-of-arm tooling.

- ***Understand bend radius requirements***—How much bending will the cable experience on a regular basis? An important factor is minimum bending radius, which is generally lower for permanent installations and higher for flexible applications. In addition, what type of jacketing is required to withstand environmental factors such as metal debris or weld flash? With appropriate planning and correct specification, the right conduit and cable chains can help to protect cables and keep work cells up and running.

- ***Use proper installation procedures***—When it comes to industrial cable, faulty installation is a common problem. From overtightening to overfilling carriers, cables are often set up incorrectly. When cables are not allowed to move freely, abrasive wear can occur and lead to premature failure.

*Advanced robotic systems, such as these high speed articulated arm robots, require equally advanced cables and connectors.*

- ***Know the difference between bending/flexing and torsional twisting***—As mentioned previously, high-flex linear motion places different stresses and demands on cable compared to torsional twisting on a specific robot axis. Specialized cables are designed to handle these torsional motions and keep cable bunches parallel to one another. Using the wrong type of cable in a highly dynamic environment will likely result in unexpected and unwelcome downtime. While flexing cables undergo constant bending when placed in a cable track, torsional applications twist the cables longitudinally during operation on a robotic arm. Be sure to specify cables that can handle bending, torsion, or both types of motion depending on the application requirements. Specialized robotic cables are rated to perform up to 10 or 20 million torsion or flexing cycles. Be sure to thoroughly investigate cable specifications or ask your cable supplier before making a final decision.

Advance planning and upfront consideration of cable choices can go a long way toward avoiding cable-related downtime—an all-too-common occurrence in dynamic robotics applications. Consulting with a knowledgeable systems integrator or cable manufacturer is an excellent place to start.