

Motion systems for intralogistics and robotics

For AGVs, AMRs, and robotics there is a lot of different technical options when it comes to a motion solution. The most drives and motors with motion controllers from Delta Line (Switzerland) used in such applications are available with CANopen connectivity.

(Source: Adobe Stock)

Modern storage and distribution warehouses are home to a variety of machines and systems, from conveyors to autonomous mobile robots. All of these have one thing in common: they all involve motion. And that motion is produced by electric motors.

Given the diversity of the equipment, the motion systems solutions must be optimally matched to its application. Delta Line, a recent CiA member, provides experience in development, design, and manufacturing of motion systems solutions for intralogistics and robotics applications.

Motion system solutions for intralogistics

With the growing popularity of online shopping in the consumer sector and just-in-time ordering in industry, distribution warehouses are springing up almost everywhere. Increasingly, they embody a very high degree of automation. Traditional conveyor, diverter, and lift systems are still frequently encountered, but now these are often partnered by automatic guided vehicles (AGVs), automatic storage and retrieval shuttles (ASRSs), and autonomous mobile robots (AMRs). Each of these presents challenges in specifying and sourcing of the needed motion system solutions.

Conveyors, for example, need robust drive systems with long operating lives suitable for continuous operation. Wheel drive systems for AGVs and AMRs must be capable of withstanding high radial loads and offer excellent dynamic performance in the smallest possible package. Robot applications require high torque density in a small package at a competitive price.

By no means do all of the requirements relate to mechanical performance. The electronic control systems for the motors must meet requirements for energy savings, easy integration with plant control systems, and

safe operation, such as safe torque off (STO) under fault conditions. And, of course, the motion system must be suitable for operation from the available supply, which, in the case of AGVs, AMRs and other mobile applications, maybe 48 V_{DC} derived from a battery. Another important challenge is ensuring that the motion system solutions are available in the required quantities when needed.

Delta Line is working in close cooperation with its customers to provide the suitable solution for their application, whether it is a standard off-the-shelf product, a standard product with customization, or a completely custom product designed for the application. The manufacturer's product range includes brushless motors, gearboxes, hub wheels, servomotors, linear actuators stepper motors, electronic controllers, and more. Since they are manufactured in-house, they can be readily fine-tuned to suit specific applications. Motors, gearboxes, and other devices can be supplied separately or as complete packages including motors, gearboxes, electronic controllers, encoders, and brakes. These integrated solutions, which are supplied tested and ready for use, simplify ordering and stocking, and reduce build and test time for the customer, leading to lower costs.

As one of Europe's largest manufacturers of motion system solutions, Delta Line claims to respond rapidly to peaks in customer demand and is also amenable to holding buffer stocks to help smooth out problems due to component shortages further up the supply chain.

Intralogistics application examples

Parcel sorting machine: The machine customer wanted a second source for an existing motion system solution. Delta Line responded by supplying a standard product with ▶



Figure 1: Parcel sorting machine (Source: Delta Line)

minor customization for the mechanical elements, complemented by a new electronic control system developed from scratch. The Delta Line solution offered enhanced performance compared with its predecessor, allowing the sorter to work with packages up to 50 kg, whereas the previous limit had been between 35 and 40 kg. The customer appreciated the high level of technical expertise that the Delta Line engineers could bring to the project and also the company's competitive pricing.

Conveyor system: This project was for a new application for which Delta Line developed a fully customized solution based on two sizes of stepper motor, complete with brakes and an electronic control system. As an initial step, Delta Line supplied the customer with separate components so that the design approach could be checked



Figure 2: Conveyor system (Source: Delta Line)

and validated. After the customer has had completed this evaluation, Delta Line combined the components to produce a fully integrated solution. Once again, the customer commented favorably on Delta Line's expertise and the keen pricing for the finished assembly and the involved development work.

Shuttle and lift drives: For this project Delta Line has provided a customized solution based on brushless DC (BLDC) motors. This application relies on a lift mechanism and a retrieval shuttle. For the lift, a BLDC slotted motor fitted with a brake was used in combination with the recent standalone Leo controller to drive the whole system. For the shuttle, six BLDC slotted motors were used, four to move the wheels, one to activate the picking arms and the last one to activate the retrieving conveyor belt. Using the Delta



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Line Phoenix multi-axis electronic controller allowed to use only two drives for the six motors of the shuttle, resulting in less complexity and smaller space. This innovative design has satisfied the customer's requirements at a very attractive price point.

Motion system solutions for robotics

Robotics is a fast-growing field integrating modern technology. Nowadays, robotic solutions in industry can be readily and inexpensively programmed and reprogrammed to meet changing product and process requirements. All robots depend on precisely-controlled mechanical movement mostly provided by motion system solutions based on small motors.

The main challenge faced by robotic system designers is the need to fit more and more into a limited space e.g. in prosthetics and industrial robot applications. The company offers (frameless) motors, with high power density suited for compact yet powerful motion solutions. Typical robotics applications also require smooth motion, with minimal cogging or torque ripple and feedback from devices such as absolute shaft encoders, to enable precise positioning. Such solutions involve complete systems including the drive electronics, feedback devices and, in some cases, a gear train. Delta Line helps to select and realize the right motion system solution for a particular robotic application. The standard or customized solutions are optimized in terms of performance, reliability, longevity, size, and cost.



Figure 3: Delta Line provides standardized and customized motion control systems for robotics applications (Source: Adobe Stock)

Robotics application examples

Dual-arm cobot: This application requires motion system solutions for five to seven axes, depending on the specification and model of the cobot. The motors had to interface easily with the customer's control system. Delta Line provided frameless motors with ratings from 60 W to 180 W to meet the needs of all cobot models. Problem-free interfacing was guaranteed by supplying the motors with customized windings. The solution enabled the cobot manufacturer to use fewer components in its products, and thanks to the compact motor construction, it could accommodate them within the body of the cobot.

Servo motor controller

Delta Line has extended its Leo drive family with the Leo B2000 drive, a closed-loop servo drive controller suitable for servo and BLDC motors. It features CANopen connectivity, compact housing (105 mm x 75 mm x 24 mm or 28 mm), and is suited for motors up to 2000 W. The operating voltage can range from 12 V_{DC} to 48 V_{DC}. The small footprint and the presence of a heatsink allow the controller to be used in size-limited applications. The device is provided with several general-purpose inputs and outputs to implement alarm signals, connect digital sensors, and activate external devices (LEDs, brakes, actuators, solenoids, etc.).

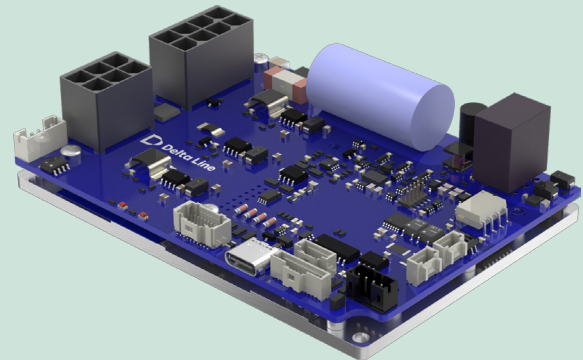


Figure: Leo B2000 drive is available with CANopen connectivity (Source: Delta Line)

The servo drive also offers the opportunity to manage a double incremental and absolute multi-turn encoder. It also implements the STO (safe torque off) function, thus fulfilling the requirements of SIL 3 (safety integrity level) according to IEC 61508. The controller is suited for applications such as automatic guided vehicles (AGVs), electric vehicles, and industrial production machines.

Drive system for automated guided vehicle: To meet the requirements for a motion system solution for the main drive wheel of an automated guided vehicle intended for use in healthcare environments, Delta Line worked closely with the end user to develop a custom-designed gearbox and housing. Delta Line supplies this as a complete and tested assembly, meaning the customer benefits from reduced logistics costs and faster, easier vehicle assembly.

Cobotic arm: The arms in this application have either five or seven axis joint motors and require very high positional accuracy. Delta Line provided motion system solutions using flat brushless DC motors ranging in size from 45 mm to 61 mm. To achieve the high positional accuracy, the motors were equipped with encoders, and, were supplied with hollow shafts to accommodate the connecting leads. This arrangement saves space and ensures that the leads are well protected against mechanical damage. ◀

of, based on information from Delta Line (www.delta-line.com)