The AGV is the latest evolution in a range of vehicles that today are tasked with manoeuvring across harsh terrain in difficult environments while providing a flexible range of operations including hauling, transportation, disposing and/or disarming of explosives, surveillance and recovery.

A ground-based unit for both industrial and military use, the autonomous vehicle is capable of reaching speeds of 40km/h. The vehicle’s robotic platform is unique in that it is omni-directional. Basically, all the wheels steer independently, which allows the vehicle to move in any direction. The AGV is also equipped with a manipulator arm allowing for 5° of freedom, and the capability to lift in excess of 45kg at full extension.

The challenge faced by the motion control engineers in the design of the AGV was three-fold. First, to provide a capable and compact drive package for a wide range of power levels. Second, to devise a way to implement a distributed motion network. Third, to upgrade from the lower power & capability solutions provided by competitors.

Systems expertise was required after the initial system for the AGV fell short on power, and did not provide genuine velocity control for the drive wheels. As a result, the vehicle had limited drive capability on an incline. Also, when coming to a halt, a final corrective move would occur, as an effect of the servos closing any position error present. In addition, the vehicle’s control system needed to be based up-on the CANopen DSP402 protocol. Direct compatibility with this protocol, and knowledge of its implementation, was required to affect simple upgrades from one manufacturer’s equipment to another.

The compact nature of the AGV required comparably compact electronics and also minimised bulk from cabling. The Falcon, Eagle and Harmonica drives, all of which offer high power density, and are designed for distributed control systems, were found to fit this requirement.

The military-specification digital drive was selected for the vehicle’s drive system, providing encoder-only velocity control for the drive wheels. Weighing less than 710g, the Eagle nevertheless offers high power - 60amps in this application from a 46-195VDc bus – in relatively compact package, together with CANopen communications. Another military specification digital drive, the Falcon, was specified for the manipulator arm control: specifically on the upper of the higher power arm joints. Designed, in common with its sister drive, for use in extreme environments, the Falcon also offers high power density from a compact package and CANopen communications. It controls the manipulator arm in encoder-only velocity mode, with absolute position feedback from an analogue absolute encoder.

The final areas of servo control on the AGV, the lower power manipulator arm joints and the platform steering are handled by Harmonica digital drives. The Harmonicas drives were selected for their compact size and ability to support up to a 200VDC bus. The platform steering is achieved in position mode using only Hall effect sensors. As with the Falcons, the Harmonicas control the manipulator arm in encoder-only velocity mode.

In addition to their performance and efficiency, the drives were also specified for use on the AGV due to their robust connection facilities and interface capabilities. The Eagle and Falcon are military specification drives that utilise D-sub style connectors. These are ruggedised and can withstand the shock and vibration encountered while the vehicle travels over rough terrain.

As regards interface capabilities, all the Elmo drives support the CANopen protocol. This allowed the drives to be mounted very close to the electrical axis, reducing overall cabling. In addition, supporting both CAN In and CAN Out terminals, allows simple daisy-chaining of the CANopen communication lines from drive to drive.

**Intelligent servo drives for an Autonomous Guided Vehicle**

*Intelligent digital servo drives have been integrated to provide a highly capable and compact drive package for a unique Autonomous Guided Vehicle.*

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