CANopen motors in automated guided vehicles

Serving as the heart of locomotion for mobile robots are integrated motors, used for steering and powering the main drive motors. These motors feature CANopen.

In smart factories, mobile robots are freeing humans from performing logistic and other tasks such as moving materials from one warehouse to another. Autonomous mobile robots (AMR) and automated guided vehicles (AGV) are the two main classifications of mobile robots on the market. Serving as the heart of locomotion for these robots are integrated motors used for steering and powering the main drive motors.

While brushed DC and AC induction motors are frequently incorporated into robots due to cost, brushless servo motors offer greater torque density, efficiency, speed regulation, life, and smoothness in motion. A variation of a brushless servo motor, the integrated servo motor offers additional benefits. Combining a servo motor and controller into one package, the integrated servo motor saves on space, wiring, and costs over conventional systems with separate motor and drive components (Figure 1). Using integrated motors, robot designers can focus less on control placement and wiring and more on non-motor system components for faster design iterations. By reducing the number of components in the system, integrated motors simplify the bill of materials, enable faster design cycles, and save money.

Integrated motors in a CANopen control network

The onboard controller of the integrated servo motor can provide the same control interface options as a separate controller, including CANopen networking (Figure 2).

Traditional Servo System
Separate motor and controller components

Robot CPU

Controller *external*

Command signals from CPU to axis

Servo motor

Power & feedback cables

Integrated Servo Motor
No external controller or motor cables required

Robot CPU

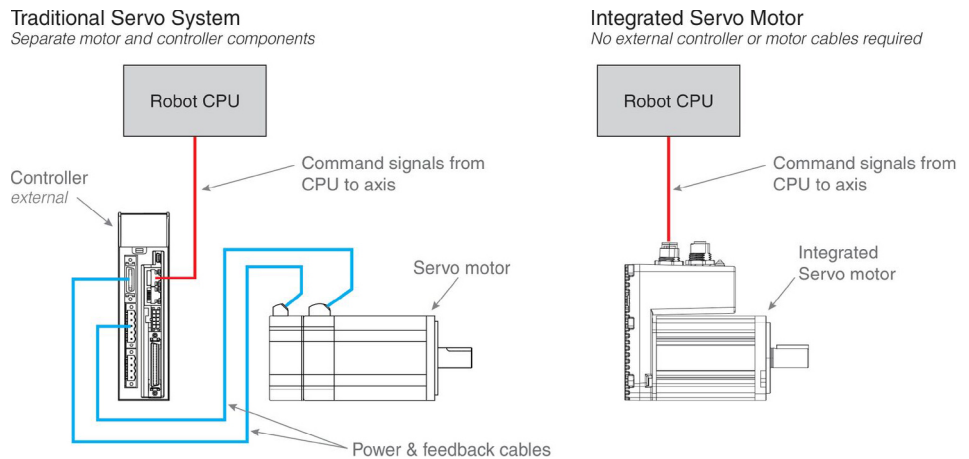Command signals from CPU to axis

Integrated Servo motor

Figure 1: An integrated servo motor eliminates the need for an external motor controller as well as motor power and feedback cables, freeing space in the robot to accommodate other material handling mechanisms, sensors or operator-interface devices (Source: Applied Motion Products)

In one AGV application, dual MDX integrated servo motors (Figure 3) from Applied Motion Products are controlled on an electrically-isolated CAN network. The electrical isolation provides a key benefit in AGV systems where a solid, reliable grounding point may not be possible for all nodes. An embedded Linux module running a CiA 301 CANopen host sends real-time CiA 402 profile velocity commands to the individual drive wheels. An integrated watchdog monitors the communications channel and ensures the ▷

Command Signal Options
Signal type does not change integrated motor size

CANopen
RS-485
Ethernet
EtherNet/IP
Modbus RTU/TCP
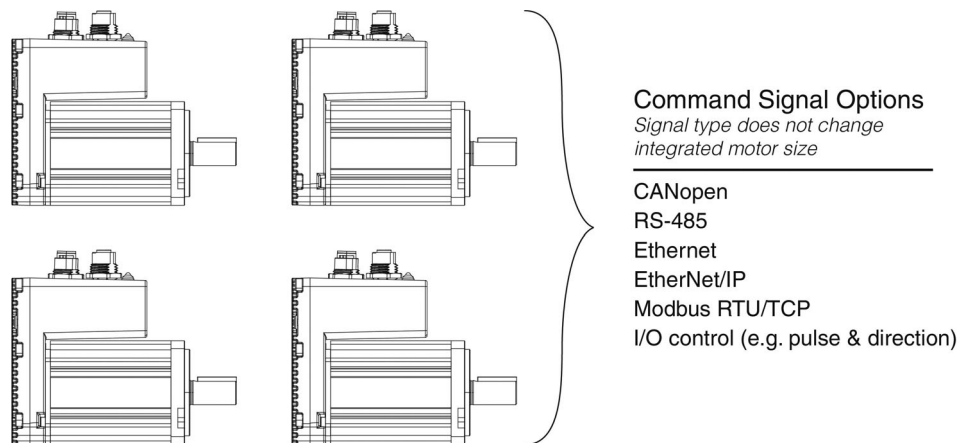I/O control (e.g. pulse & direction)

Figure 2: Integrated servo motors provide the same control interfaces as separate servo drives, including CANopen and other industrial communication protocols (Source: Applied Motion Products)

Figure 3: Photo of an MDX integrated servo motor where control electronics are housed at the back of the motor, near the feedback device. No other external electronics package is required to drive or control the motor. The motor includes connectors for power, communications, and I/O. Its on-board controller utilizes the same command interfaces as external motor controllers including CANopen.
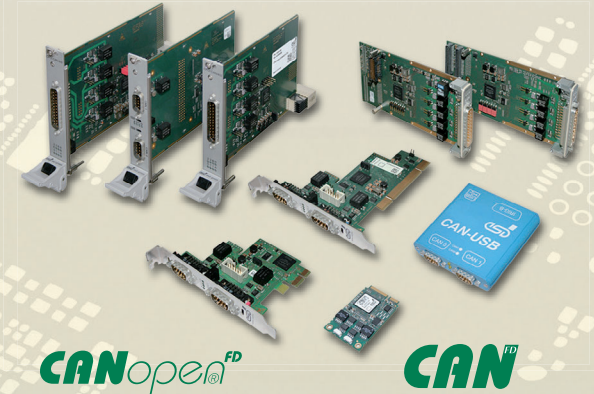
vehicle stops safely if the host encounters a communication problem.

In addition to simple velocity commands, the use of the CANopen network allows the host to monitor important drive conditions such as temperature, drive status, and the actual current being delivered to the motors, all without the use of additional wiring or sensors. Along with the two drive wheels, a J series servo motor from Applied Motion is used with a DC-powered SV200 servo drive to power the lift axis of the AGV. The lift axis runs in a CiA 402 profile position mode to move to one of several pre-determined locations depending on the task.

In addition to acting as CANopen slave devices, MDX integrated servo motors can run stored programs that incorporate commands for various kinds of motion, I/O control, and machine sequencing, as well as math functions that enable users to create complex motion profiles and control algorithms. MDX motors feature two environmental rating options, IP65 and IP20. The most popular IP65 rated motor includes M12 connectors for all connection points. IP20 rated motors feature pluggable connectors that save cost in high volume, price-sensitive applications. ◄

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