Speed Profiling Features in Standard Drives Offer Flexibility For Material Handling Systems

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It is easy to understand how users might confuse speed profiling and motion control. Both technologies involve a form of positioning. When deciding which form to implement, a user should understand the key differences and application environments.

Motion control is the science of precisely positioning the movements of a machine without human intervention. Motion control products are used in applications requiring repeatability and accuracy to within 0.0001 of an inch.

In the packaging industry, manufacturers use motion control to form, fill and seal bags and then precisely position the bag for labeling. In industrial applications, motion control consists of a controller, an electrical amplifier and a feedback device. The controllers measure the position of a moveable machine axis, and then move the axis to a new position according to a predefined program.

Speed profiling expands standard drive applications

Not all applications require such high precision. Users looking for simple speed step changes or basic positioning can take advantage of the speed profiling features offered by standard drives. Whereas motion control drives focus on precise positioning, standard drives focus on velocity control. In general, manufacturers use standard drive products in applications that require speed and/or torque control, without position control. Position accuracy is dependent upon system dynamics and encoder resolutions. A typical application that uses a standard drive runs at a certain speed for a specified period of time before changing speed and duration. Speed profiling is appropriate when the axes' velocities need to be controlled without coordinating or aligning those axes in a particular position.

Given the lower precision, speed profiling drives are suitable for applications where

the controlled axis returns to a home position. For example, a bottling OEM can use a speed profiling drive to control the raising and lowering function of a sweeping arm on its de-palletizer, a machine designed to remove bottles from a pallet. The arm starts from a home position and then moves a pre-determined distance as conveyors remove each successive group of bottles from the pallet. When the last bottles are removed from the pallet, the drive signals the motor to move the arm to a home position, where it waits for the next pallet to be moved into place. The cycle is then repeated.

Without the periodic return to the home position, the slight degree of inaccuracy inherent in drive-controlled machinery will become a problem after repetitive cycles. For example, if at the end of each pallet, the sweeping arm were moved to a point defined to within a tenth of an inch, the machine would function perfectly-for that cycle-because the sweeping arm does not require a high degree of precision. However, if that tenth of an inch of inaccuracy was allowed to build over 10 successive cycles, the sweeping arm could theoretically be off as much as a full inch - a sure recipe for broken glass. Speed profiling drives are best suited for applications that will tolerate a small degree of imprecision and that include a built-in home position to prevent slight inaccuracies from building from one cycle to the next.

Traditionally, manufacturers had to use an external programmable controller to change the speed command in the drive at a specific point. With integrated speed profiling in drives, users can program speed changes without the addition of an external controller. To obtain the high performance available in motion control, manufacturers can use special motors with low inertia, permanent magnet rotors, which saves space.

Motor control of speed profiling?

As OEMs in the material handling industry begin to embrace speed profiling drives, the following key factors should be considered:

• Ease of use. This is critical to the successful adoption of speed profiling drives. If the drive is difficult to use and program, any throughput gains can be lost as engineers and operators scratch their heads and call for tech support.

• Programmable drives. Look for speed profiling drives that are programmable, eliminating the need for a separate programmable logic controller.

•Accessible diagnostic information. Drives that display easily referenced fault codes when problems arise can reduce downtime during a malfunction. Look for a startup menu that reduces startup complexity and gets applications up and running quickly.

•Vendor support. Lastly, OEMs and integrators will want to work with a vendor that has a strong presence in the automation industry, and can provide assistance with the design, selection and integration of a speed profiling drive.

In addition to these general considerations, the user should determine accuracy and

repeatability needs of the application. While both motion control products and standard drives with speed profiling control velocity, torque, and (to some degree) position, the precision at which they do this varies greatly. If precision is key to the application, then motion control is the solution. If position control is not necessary and the velocity steps are repeatable, a drive with speed profiling should be considered.

If the application lends itself to speed profiling, users can program a sequence of speed transitions up to 16 steps. Each step is activated based on an encoder pulse count, a specific time interval, or by toggling a digital input in the drive. The sequence of the profile can be a single cycle (with a "return to home") or a continuous loop (with a "return to step 1" routine). Each speed-step has three parameters for configuration: the step RPM speed, units of travel, and the type of index or move needed to be performed.

Drives with speed profiling give users "unblended" or "blended" operation. Unblended operation means that the system speed does not "blend" from one command to the next. In unblended operation, the drive brings the motor down to zero-speed between successive speed-steps if a "hold" command is present. Users can command the drive to stay at an unblended, stopped position for as long as needed before moving to the next speed-step. With blended speed, there is no hard, timed stop between step changes - the speed will ramp smoothly from the speed of one step to the speed of the next step. A "hold" command in blended operation will hold the drive at the speed of the current step until the hold is released.

Speed profiling in high-performance, general-purpose drives offers control for applications that do not require the high-speed response or tight accuracy of servo positioning control. This feature can be used for simple positioning requirements in applications such as palletizers, turntables, hemmers, gantries, run-out tables, transfer shuttles and station gates.