Tuba

Cornet

Application Solutions Case study:

Box Labeling Application

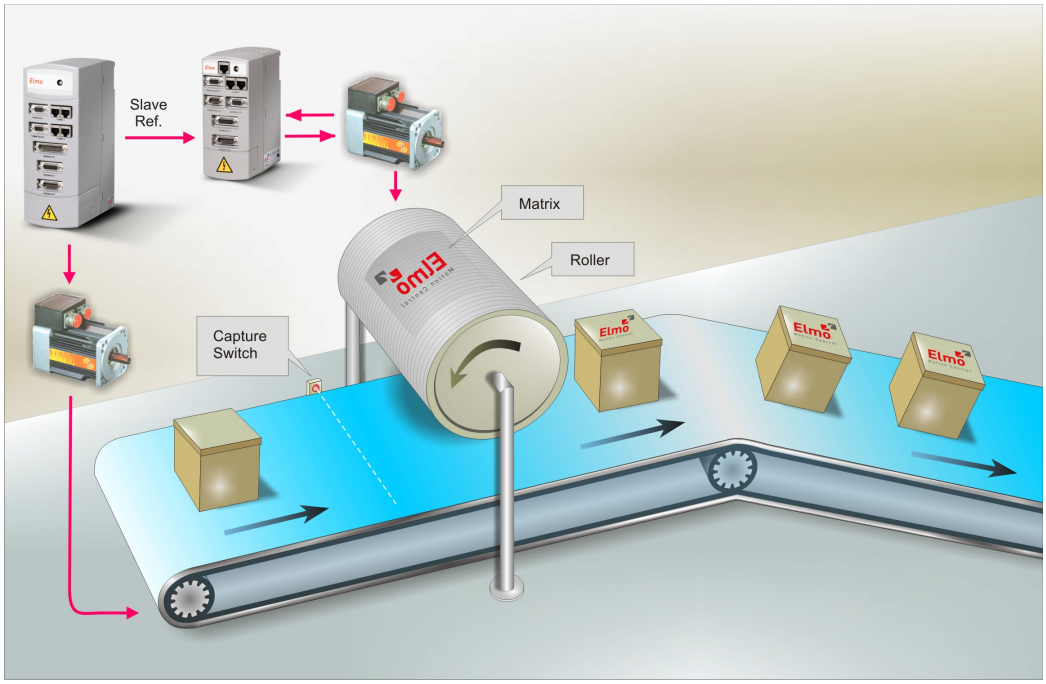
Product names – Tuba & Cornet

Elmo
Motion Control
www.elmomc.com

Using the Tuba & Cornet digital servo drives, Elmo Motion Control has implemented a unique ECAM-based solution for managing an application that prints labels on boxes moving at irregular intervals along a conveyor.

The Challenge

When automating a labeling application using a printing roller, one needs to take into account the speed of the mechanism moving the item to be labeled, in conjunction with the rotation speed of the labeling roller. These two factors are independent of the distance between two consecutive boxes, and between a single box and the labeling roller. In the case presented here, a conveyor carries boxes towards a roller assembled above the conveyor. An optical device mounted on the edge of the conveyor in front of the roller captures an incoming box and "notifies" the drive controlling the roller to prepare for printing the label. The roller is engaged, the label is printed and the roller is subsequently disengaged until notified of the next incoming box.



For this scenario, Elmo Motion Control devised a master-slave configuration in which the Tuba digital drive serves as the master that controls the conveyor. The labeling roller is the slave, driven by the Cornet. The arrival of each box is indicated by a high-speed digital input that captures the master location and sends the signal to the slave (Cornet). Upon receipt of that signal, the roller is homed to the position of the first label and, as the box arrives at the appropriate place, it is engaged and prints the label. The roller disengages after the print, unless another capture signal has been sensed and another box arrives for printing. The roller contains two labeling matrices, so that an entire roller cycle prints labels on two boxes.

The challenges in such an application arise from the fact that the boxes on the conveyor do not travel towards the labeling roller at regular intervals, requiring a mechanism for disengaging the roller on-the-fly and then re-engaging it after it has been rotated to the

proper position for printing the next label. Furthermore, this type of labeling procedure requires on-going adjustments of the labeling roller speed to that of the conveyor speed. To achieve synchronization, the absolute position of the roller (slave) must be adjusted after each print cycle in order to prepare for the subsequent one. At the same time, the conveyor (master) motor position must roll over (start a new revolution) without losing synchronization with the position reference of the roller.

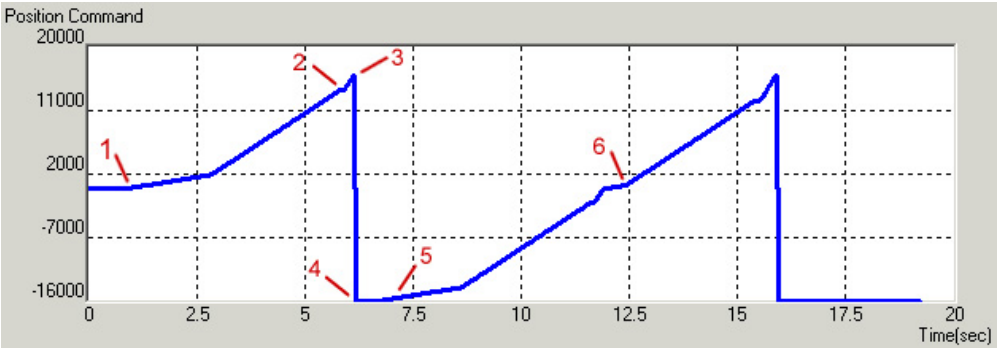
Elmo's Solution

In order to synchronize the roller speed with the conveyor speed for printing, so that the box arrives at the roller when the roller has been rotated to the right print point, a preprogrammed ECAM table was created and installed in the slave drive, to be used as a reference table for positioning the roller for printing. The ECAM table describes the nonlinear trajectory of the roller, ensuring that the roller speed exactly matches that of the conveyor when the box reaches the print location. To achieve this, the Cornet drive counts in modulo when it exceeds the slave-roller position limits (a full revolution), maintaining the velocity command as the motor begins a new revolution.

The home location for the roller can be either the absolute home location or the modulo rollover location of the roller, which is half of the roller cycle (for printing the second label). This depends on if one or two boxes arrive at the same time. The actual home position for start of printing is therefore determined by the offset of the master capture, which determines at what step in the ECAM table to begin the slave trajectory. The trajectories remain the same, regardless of conveyor location and roller start position.

Recording the Slave Trajectory

This record of the slave Position command demonstrates the roller trajectory when one and then two boxes arrive at the printing area. The slave (roller) is a 32,000-count motor. The printing area occurs between locations 10,000 and 14,000. After printing, the slave continues to its home location according to the software relative command that it receives.



Sample trajectory of slave roller

Upon receipt of a software command, the slave accelerates from point 1 to point 2, printing a label on the box. Point 3 indicates the location at which the first label is fully printed, at which point the slave continues with a point-to-point movement to point 4, awaiting the arrival of the next box.

The next box arrival is captured at point 5. The roller begins to accelerate again and begins printing at about -14,000 counts. While this box is being printed, another box arrival is captured and at point 6, an immediate follower engagement is performed in order to print the third box.

Each print takes 14,000 counts and the homing takes 2,000 counts more. As can be seen from the graph, the trajectories are the same regardless of conveyor location and roller start point, and if one or two boxes arrive at the same time.

Consistent and Reliable, at Any Speed

Thanks to the ECAM-based operation of the master-slave configuration and the ability to engage/disengage the roller motion on-the-fly, the box labeling application operates smoothly despite variable speeds of the conveyor and different distances between boxes. The label printing proceeds exactly as required for any number of boxes, arriving at irregular intervals. It's a very accurate solution for what could be a complicated and erratic printing process.

Tuba & Cornet Digital Servo Drives

The Tuba & Cornet - digital servo drives feature high-quality servo performance aligned with sinusoidal vector control. These drives are highly flexible, operating in a range of modes: current, velocity, position and advanced position (PVT, PT, ECAM and Dual Loop). Very efficient networking is accomplished via CANopen.

Both drives are very compact and connect directly to the mains power source (up to 480 VAC). The Tuba drive delivers up to 10 KW of power; the Cornet, up to 2.5 KW. The drives can be manually or automatically tuned using Elmo's Composer application for drive setup, configuration, tuning, logging and analysis.

For more information on Elmo:

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