


**ROTARY STAGE FOR CLOCK AND BELL DISPLAY**

## It's Hammer Time!

**A**t the top of each hour, a proprietary controller sends a signal via RS-485 link to twin controllers, causing them to execute a motion profile program that drives each of two sculptures. A NEMA 34 stepper motor running in the open-loop mode in conjunction with a 15:1 right angle gearhead provides enough torque to drive the system. An open gear reduction of 5:1 between the gearhead output pinion and the slewing ring gear on the stage platen maintains a favorable inertia ratio between the rotating sculpture and the motor. This configuration allows the system to accelerate the sculptures at approximately 1 rev/sec<sup>2</sup> to speeds in excess of 20 rpm when executing their motion profile. The completed rotary stage is repeatable to  $\pm 2$  degrees, with most of the position error due to backlash in the open gearing comprising the final stage of the drive train. The easy programmability of the ZETA system allowed for a dynamic and realistic motion profile.

**APPLICATION:** An 8-ft diameter clock with a pair of life-sized human sculptures that rotate to simulate striking church bells with large hammers (the bell sound is digitally reproduced). The two sculptures are mounted on custom rotary stages powered by a step motor system.

**LOCATION:** The Grove at Farmer's Market Los Angeles, CA

**DESIGN ENGINEER:** Michael Elson  
Electric Time Co.

**ENGINEERING CHALLENGE:** Design an economical low-profile rotary stage with sufficient torque and power to produce an aesthetically pleasing motion.

**SYSTEM SPECS:**

- Sculpture weight: 120 lbs
- Moment of inertia: 21,000 lb-in<sup>2</sup>
- Maximum motor acceleration: 60 rev/sec<sup>2</sup>
- Maximum motor speed: 25 rev/sec
- Position accuracy (rotary stage):  $\pm 0.2$  degrees
- Motion profile: Position vs. time

**MOTOR/CONTROLLER/DRIVE SPECS:**

- ZETA 83-135 Step motor, (Compumotor)
- 2-phase hybrid permanent magnet, 1.8 degrees
- NEMA 34 frame size
- Max torque: 382 oz-inch
- 15:1 right angle gearhead (Bayside NR345-015)
- ZETA 6104 Single-axis packaged drive/indexer system, (Compumotor) proprietary controller (99B-MI Controller, Electric Time Co.)

**WEB RESOURCES**

//For more information on Electric Time's 99B-MI Clock Controllers, go to <http://bit.ly/1m3ca3849-562/>