



## Application note 102: CM-120 size 11 servo motor/encoder

This note describes the actuator solution provided by Allied Motion for a military ‘seeker’ application. The seeker employs a revolutionary “ball joint” way of scanning/tracking and supports very high rates of acceleration/deceleration such as experienced by cannon-fired munitions.

The seeker head consists of a free-floating ball + camera assembly in an air bearing. The four actuating motors are connected to the ball by means of four Kevlar wires, not unlike the muscles in a human eyeball. The four wires are wound/unwound in tight conjunction under control of intricate software in order to point the camera in a particular direction.

Design constraints for the motor/encoder were as follows:

- small size (1.1” cube max.)
- minimum torque of 10 oz.in for 45 sec.
- minimum encoder resolution of 1 arcsec.
- high bandwidth
- acceleration in excess of 10,000 g’s
- balanced rotor

The desired motor characteristics were more than met with a 10 pole EMOTEQ motor, optimized for a very high torque output over a short amount of time. Special bearings were utilized to withstand the acceleration load of the shaft, inner races of the bearings, rotor and encoder disk.

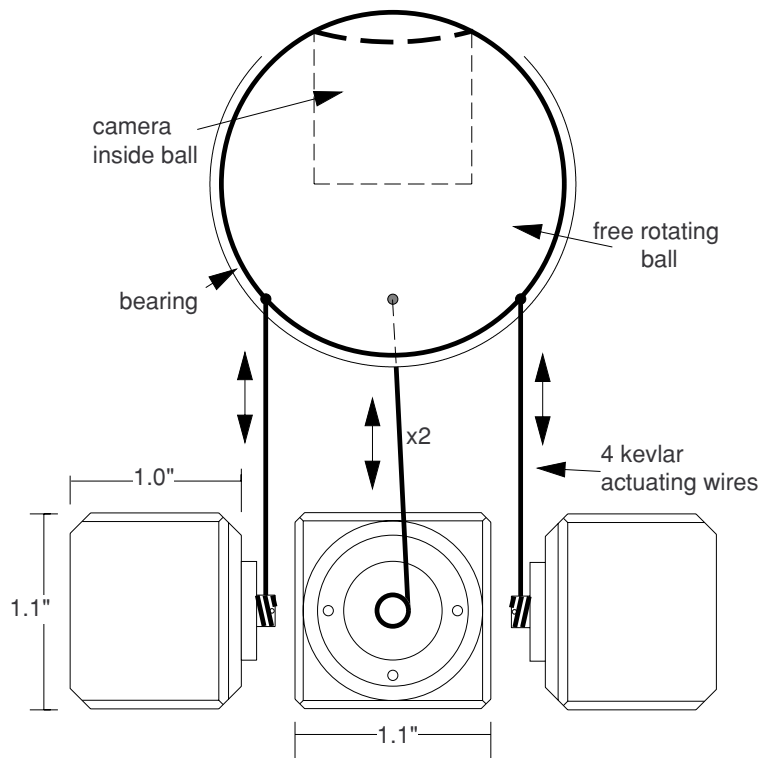
The encoder is a COPI very low distortion sine/cosine type which yields a resolution in excess of 1.29 million points per revolution after interpolation (better than one arcsecond). This is necessary because of the “direct drive” nature of the architecture - the motor makes less three rotations for targets that are at a distance of a mile, making a high resolution per turn mandatory to achieve the required accuracy.

The CP-120 commercial version has found other application such as high-speed scanning etc.

For information and assistance, please contact:

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EMOTEQ (800) 221 7572 technical assistance,  
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CM-120-1024 commercial version  
without special “seeker” shaft