ASSEMBLY 2000

History will look upon the late 20th century as the golden age of information and technology. As science fiction becomes science fact, we are flooded with a dizzying array of increasingly complex consumer products. From wearable cell phones to PDAs (Personal Digital Assistants) with more computing power than previous generation supercomputers, the proliferation of miniaturized electronic devices has profoundly changed the world in which we live.

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In the midst of our "Brave New World," we discover that the fundamental cost of the electronic devices and their inherent complexity has resulted in a generation of throwaway products. High-speed production coupled with miniature embedded components has nearly eliminated the practice of rework or post-production repair. This reality has fueled the drive to further decrease production costs. The three major elements to accomplish this are throughput, yield, and downtime. The next generation of machines will be designed to require even less maintenance, while at the same time producing nearly flawless parts in record time.

As electronic assembly heads into the next millennium, it is somewhat ironic that at the center of this high tech revolution will be a technology that has been around for decades. Linear motors, the direct-drive technology born out of late 1800s research, is uniquely suited to meet these needs and is rapidly becoming a staple of modern assembly operations. While the technology behind the brushless linear servomotor is quite mature, only recently have the supporting electronics - high power amplifiers and sophisticated motion controllers - become cost-effective enough to bring this technology into the mainstream. In addition, the rare-earth magnets that are required for today's demanding applications have only been readily available recently.

Engineers throughout the industry are demanding machines capable of higher speeds, greater accuracies, and improved reliability. The linear motor is uniquely suited to meet these demands. Traditional pick-and-place machines have largely depended upon belt drive and mechanical-screw-driven mechanisms. Belts, while capable of high speeds, are not very accurate or repeatable, while the more accurate ball screw's top speeds are only a fraction of that offered by a belt. Linear-motor-based systems are capable of speeds far in excess of belt-drive mechanisms, while achieving accuracies unheard of for a ballscrew. Greater speeds and accelerations result in a system with vastly greater throughput and, therefore, much improved productivity. A completely noncontact device, there is absolutely no wear associated with the linear motor and zero scheduled maintenance. This unheard of reliability results in dramatically reduced system downtime over the life of the machine.

To support the linear motor drive mechanism will require an evolution in the drive and control schemes. Simple clock-and-direction stepping indexers are being replaced with sophisticated DSP-based controllers. Coupled to these controllers are "smart" amplifiers with their own on-board fault handling. As the only manufacturer to produce a complete line of linear-motor-based positioners with a matching line of amplifiers and controllers, Aerotech has simplified this transition. The inherent complex nature of the linear motor does not lend itself to the patchwork systems approach that is common practice throughout the industry. Drive systems will be provided as complete sub-assemblies, ready for immediate integration into the end machine. In many cases a turnkey linear-motor-driven gantry system will be provided, allowing assembly companies to focus on their true value added portion of their machine.

This superior technology does not come without a price. The initial cost of linear-motor-based systems tends to be slightly higher than comparable ball screw or belt-driven systems. However, designers will quickly realize that the return on investment is significantly shortened. Greater throughput will not only increase production, but effectively increases capacity by reducing the number of machines required for a given output level. Higher accuracy will allow the next generation of miniaturized products to be produced, and also increase overall yield and reliability of the end product. Finally, the concept of a maintenance-free device with nearly zero downtime results in unheard of efficiency levels. Much as the cost of a computer has become insignificant compared to the exponential increases in productivity, the implementation of direct-drive devices will have far-reaching implications for the entire assembly process.

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