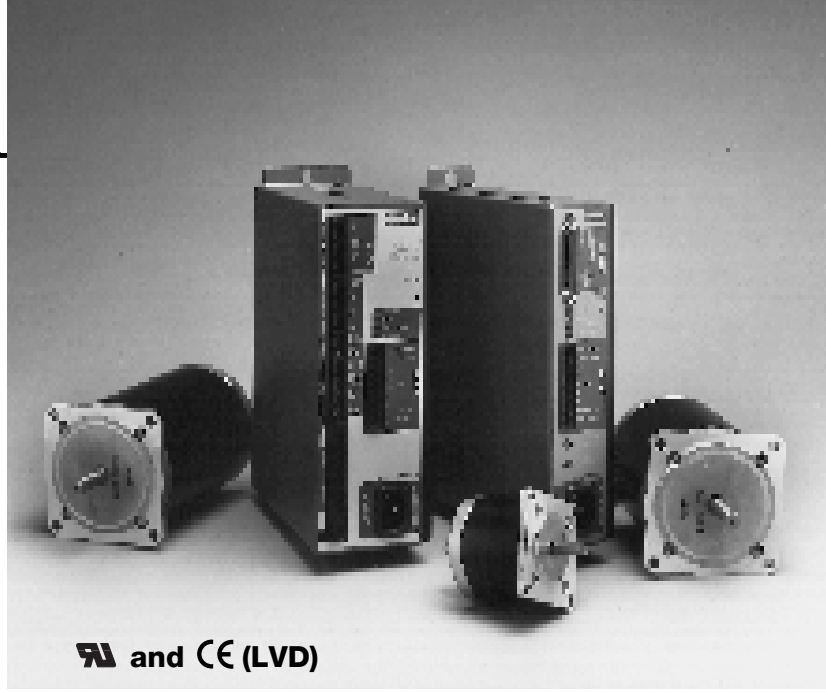


The ZETA Series

Microstepping Systems: the Next Generation

The ZETA Series provides a user-friendly system that delivers high performance and reliability in two packages—the ZETA4 drive and the ZETA6104 drive/indexer. The entire series incorporates the breakthrough techniques known as Active Damping and Electronic Viscosity (patents pending). This combination of innovative features makes the ZETA Series the smallest, highest performing and most cost-effective microstepping system available today. Furthermore, the entire series incorporates the latest developments in ASIC (Application Specific Integrated Circuit) and FPGA (Field Programmable Gate Array) technology.

The ZETA drive is perfect for multi-axis applications and allows control by any standard step and direction or clockwise/counter clockwise indexer.

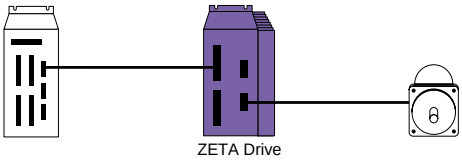
The ZETA6104 combines the power and reliability of Compumotor's ZETA drive with the flexibility of Compumotor's 6000 Series of indexers. This advanced design makes the ZETA6104 the highest performing, single-axis system in the industry.

Like all 6000 Series products, the ZETA6104 uses the 6000 Series command language—a powerful command language that is flexible enough to implement complex motion control applications and simple enough for the novice programmer. The ZETA6104 is also compatible with Motion Toolbox, DDE6000 Server and Motion Builder for additional application ease-of-use and flexibility.

The ZETA6104 can operate stand-alone, interface to PCs and PLCs or can interface with Compumotor's remote operator interface, the RP240.

Software information is available on page C90.

Parker Hannifin Corporation
Compumotor Division
Rohnert Park, California



Designed with the user in mind . . .

Selectable Output Current

Standard 25 Pin D Connector for Indexer-to-Drive Connection

Reset Input to Allow Indexer to Easily Reset Drive

LEDs to Easily Identify:
- Power, Drive On
- Step Pulses
- Drive Over Temperature
- Motor Short Circuit

Step Bicolor LED:
Green – indicates incoming step pulses
Red – indicates automatic test

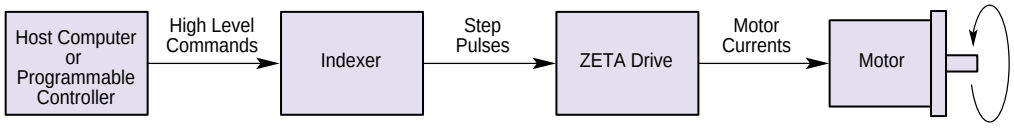
Easy-to-Use Removable Motor Connector

Selectable Damping for Optimized Performance, and Smooth, Resonance-Free Motor Operation

Standard Molded Plug for Easy Connection to AC Power

Short Circuit, Ground Fault, and High Voltage Protection

The Compumotor optically isolated step and direction or clockwise/counterclockwise interface allows the ZETA Drive to connect to any Compumotor indexer or the user's supplied pulse train.



Parker Hannifin Corporation
Compumotor Division
Rohnert Park, California

ZETA6104

Compumotor combines the power and flexibility of the 6000 Series controls with the revolutionary design features of the ZETA drive to provide our most dynamic single-axis indexer/drive package to date.

With a 6000 controller built in, the ZETA6104 has 19 inputs, 9 outputs, RS-232C/422/485 communication, operator interface options and following capabilities needed for single-axis applications. In addition, all of the 6000 Series compatible software is available starting with Motion Architect® Windows™-based development software. The ZETA6104 is also compatible with Motion Toolbox™, DDE6000 Server, and Motion Builder™ software packages.

Selectable Output Current

Configurable RS232C or RS422/485 ports

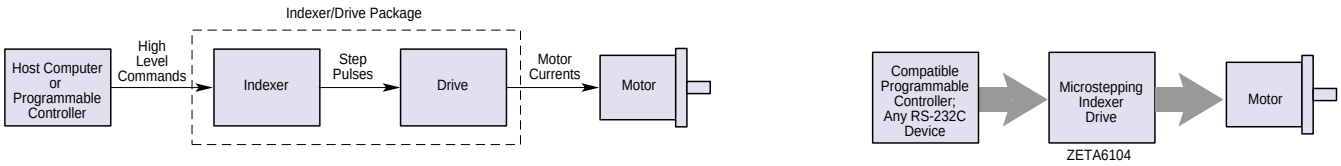
LEDs to Easily Identify:
- Power, Drive On
- Step Pulses
- Drive Over Temperature
- Motor Short Circuit

All Inputs and outputs are optically isolated and short-circuit protected

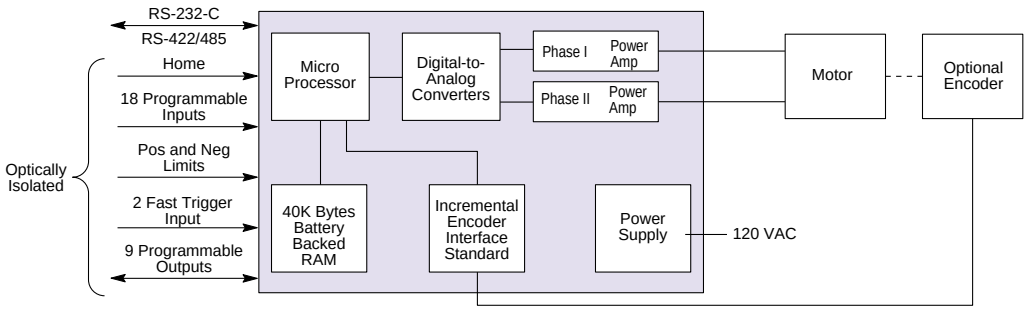
Easy-to-Use Removable Connectors:
- Motor
- Communication
- Encoder
- Limits
- Auxiliary I/O

Standard 50-Pin Header Connector Compatible with Opto22 & Grayhill

Standard Molded Plug for Easy Connection to AC Power



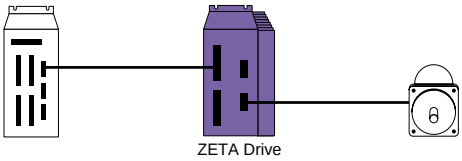
ZETA6104 System Diagram



C Step Motor Systems

Parker Automation

Parker Hannifin Corporation
Compumotor Division
Rohnert Park, California



Major drawbacks of open loop systems are solved . . . with the ZETA Drive.

Step Motor Systems Can Stall

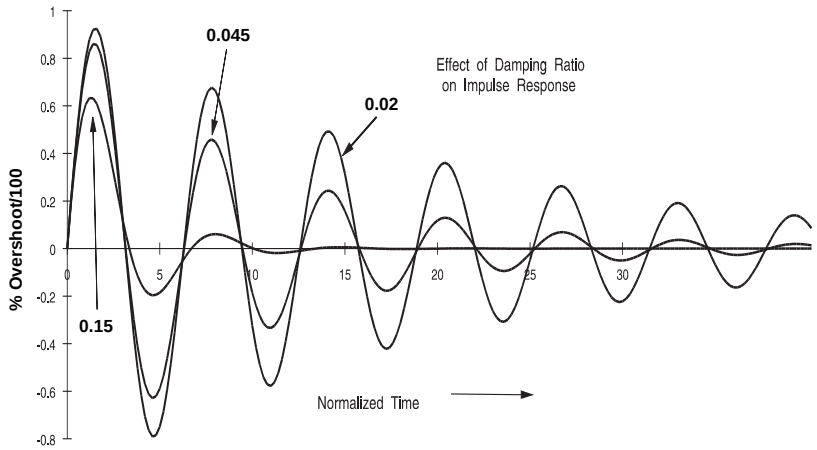
When the torque demand on a step motor system exceeds the torque available, the motor can lose synchronization; this is known as stalling. Stalling most often occurs when a step motor is commanded to do a move that it cannot perform. In some cases, however, a step motor can stall even when it is capable of making the move. In these cases, the step motor system vibrates so dramatically that the *available* torque is not adequate to overcome the vibration and make the move. When operating the step motor near a system resonance point, the likelihood of a stall due to vibration is greatly increased.

Minimize Stall Condition

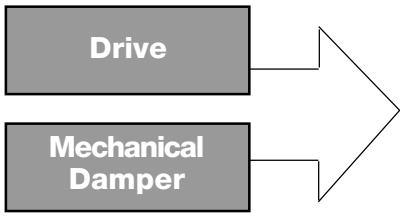
To minimize the likelihood of a system stalling, step motors require damping (e.g., decreasing an oscillation). The more damping, the faster the oscillation decreases. A highly damped step motor system will be able to perform to the rated specifications.

Previously, the most common way to increase the damping of a step motor system was by mechanical means. Mechanical dampers are mounted to the back of the motor and come in a variety of types. The most common and effective type of damper is a complex mechanism comprised of a seismic mass suspended in a viscous fluid.

Effects of Damping



Notice that the plot of the system with a damping ratio of 0.02 shows significant ringing activity while the plot of the system with a damping ratio of 0.15 shows a very quick settling time. The goal of motion control systems is to execute a move rapidly with minimal overshoot and minimal settling.



Parker Hannifin Corporation
Compumotor Division
Rohnert Park, California

Higher Performance

Mechanical dampers do not always provide a perfect solution. Mechanical dampers are sized to the load. If the load changes or mechanical wear occurs, the damper is no longer as effective. Furthermore, mechanical dampers add significant inertia to the system, greatly reducing the maximum system acceleration.

The ZETA Series provides damping electronically, with no additional devices to connect. Compumotor's electronic damping is configurable, so it can change if the application changes.

ZETA Series Benefits:

- Stalling is minimized without the additional expense and inertia of a damper
- Higher acceleration
- Higher performance

No Cost Damping

Mechanical dampers are expensive; a good one can cost two to three times more than the motor! The ZETA Series offers electronic damping at no additional cost.

Fewer System Components

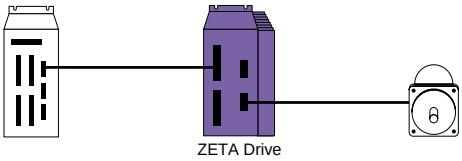
Compumotor's ZETA Drive addresses one of the major concerns of open loop systems—multiple components. The ZETA Drive is a single-component solution. Conventional step motor systems would require two components—the drive and an external damper.

System Reliability

Fewer components mean increased reliability. Since the ZETA Drive does not require a damper; issues regarding damper mounting and reliability are eliminated.

Reduce Cost

The ZETA Drive increases simplicity and reduces overall system cost.



Increased efficiency and reduced settling time . . . improves throughput.

Where Does the Power Go?

In any motorized system, electrical energy is converted to mechanical energy. This mechanical energy turns the motor shaft and produces the shaft power. The shaft power rotates a directly coupled load or linearly moves the load through a mechanical translation device. In a traditional stepper system, only 66% of the power is available to do useful work—accelerate the load and overcome friction. The remaining 34% is reserved as a safety margin to provide torque to overcome mechanical vibration when necessary.

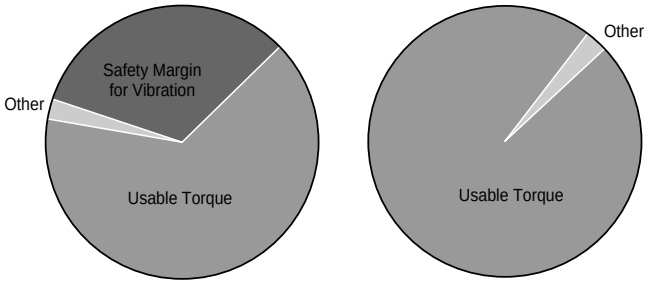
More Power to the Load

Compumotor's innovative Active Damping electronically damps motor vibration. By eliminating vibration, the power formerly reserved for the safety margin can now be used to do useful work. This can provide as much as a 50% increase in usable torque.

ZETA Series Benefits:

- Decrease motor vibration
- Reduce audible noise
- Increase usable shaft power

Comparison of Usable Shaft Power



Traditional Stepper System | **ZETA Series**

Do I Still Need a Safety Margin?

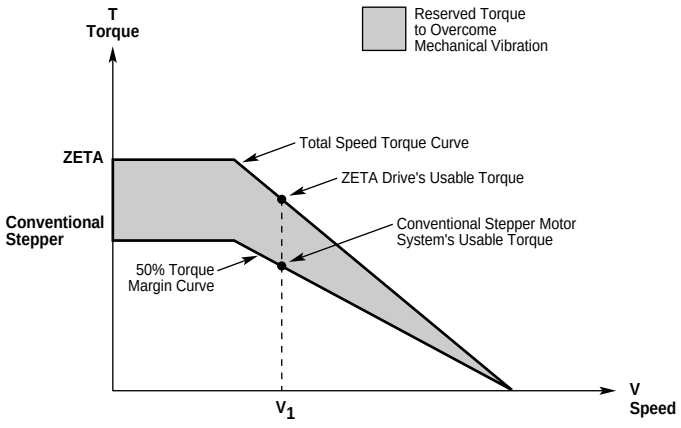
It's up to you. Your decision should be based on:

- Calculation confidence
- Changing load condition
- Kt (speed-torque curve) variance
- Frictional changes
- Mechanical wear

More Usable Torque at All Speeds

In conventional step motor systems, the speed-torque curves represent the motor's total shaft power, not the usable shaft power. As a result of Active Damping, Compumotor's ZETA system has greater usable shaft power. This higher usable shaft power results in higher toque at all speeds compared to conventional stepper systems.

Torque vs. Speed Chart



Parker Automation
Parker Hannifin Corporation
Compumotor Division
Rohnert Park, California

Reduced Settling Time

The figure to the right shows an example of the ringing that results at the end of a typical move using a load inertia six times the rotor inertia, commanded to change velocity from 4 rps to 7 rps. In this undamped system, it takes more than 1,860 milliseconds for the motor to settle. Using the ZETA Drive, the settling time is reduced to 20 milliseconds. Actual ringing and settling times are application-specific and depend on move parameters and the inertia of the load.

With conventional stepper systems, after each move the shaft oscillates around its commanded final position before settling. This increased settling time is actually wasted time.

Compumotor' patent pending Electronic Viscosity damps the ringing of the motor system when accelerating/decelerating the load from 0–3 rps.

ZETA Series benefits:

- Decrease settling time
- Increase production time
- Increase slow-speed smoothness (reduce velocity ripple)

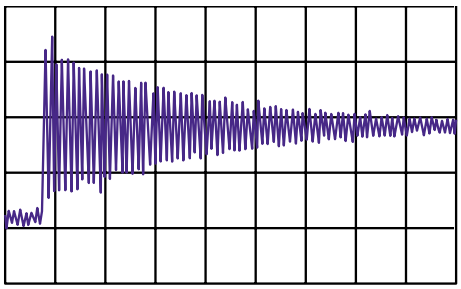
Increased Throughput

The figure below shows an example of a repetitive move profile in an indexing, pick and place, or similar type of application requiring some type of action to occur between moves (i.e., scanning, probing, measuring, etc.). It is sometimes critical for the machine to be settled within a given tolerance before the action can occur. The conventional step motor system requires a significant amount of time (wasted) to settle.

The ZETA Series improves machine throughput by decreasing settling time and allowing the motor's torque to be used for greater acceleration instead of overcoming the step motor system's vibration.

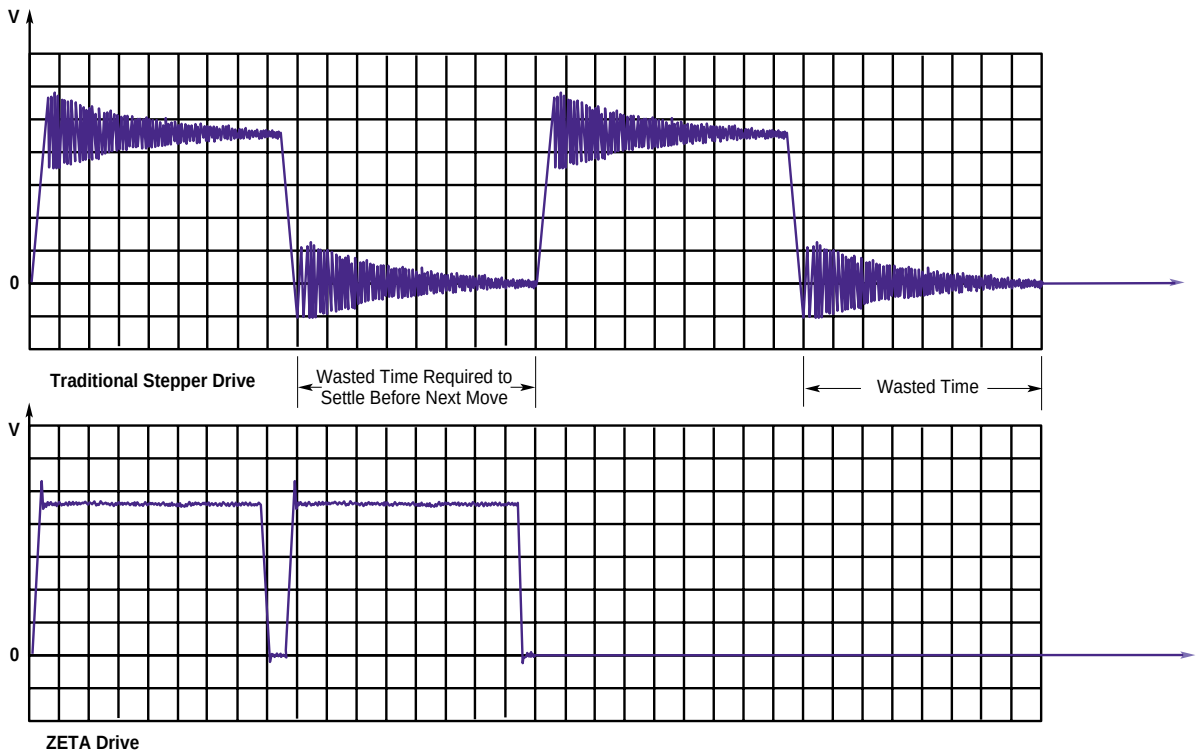
The improvement in the throughput depends on the stiffness of the machine, load inertia, length of the moves, and time between moves.

Settling Time



Traditional Stepper–Settling Time = 1860 Milliseconds

Throughput



C Step Motor Systems