The Parker Gemini Family: GV6 and GT6

The Gemini family of motor drives is a small, low-cost, high-performance solution to today's motion control needs. Consisting of both servo- and stepper-motor technologies built on a common foundation, the Gemini family offers a unique advantage to machine builders and systems integrators. Seven power levels, three control levels, numerous connectivity options and new cost-saving features make Gemini the right choice.

The challenge was to design a family of drives with small package size, highly flexible control capabilities, lots of connectivity options and cutting edge technology to make application (design) solutions simple.

What Parker came up with is an innovative, low-cost, small-footprint, very flexible, high-performance family of servo and stepper drives and controller/drives designed to solve the most rigorous of applications with ease.

Machine builders have always had many choices between servo- and step-motor technology. Until now, no single platform was available that addressed both these technologies. Design engineers were forced to research, identify and learn two very distinct types of hardware. In the end, who was to say all the pieces would work together?

The Gemini family is designed to put the users' mind at ease. A common platform gives access to a wide range of product offering in both motor technologies. No longer will the fear of mixed technology stand in the way of efficient, cost-effective motion control solutions. The Gemini platform allows choices not only of motor technology, but power level, level of control intelligence and connectivity with myriad optional communication protocols. This flexibility allows application needs to be matched exactly. Best of all, this is available within a cohesive product family that maintains a common look and feel. Whether your application requires a single-axis follower drive or even a drive with distributed control capabilities, there's a Gemini amplifier that fits the bill. A wide range of connectivity options such as RS-232, RS-485, digital I/O and many fieldbus protocols, allow the Gemini to communicate with most machine peripherals, making system integration simple.

Product Architecture

The family architecture consists of multiple control options centered around a DSP based core, coupled with a custom mixed-mode ASIC to handle all peripheral needs. Analog and digital inputs, PWM generation, encoder output, triggers and communications have all been integrated into a single component, greatly decreasing package size while increasing product reliability. By off-loading all background tasks to this custom ASIC, the DSP can focus on the important task of motion trajectory generation and motor control.

The amplifiers utilize digital current loop technology that makes system configuration simple. It also removes the need to adjust drift prone potentiometers; thereby guaranteeing repeatable system setup, configuration and performance. This digital platform also allowed the implementation of several new technologies designed to increase system performance and reduce overall system cost.

All functional blocks are designed for commonality throughout the platform. From internal hardware modules like power supplies and fault handling, to the external hardware of chassis and heat-sink, all are shared throughout the family. From the mains input to the user

interface, the family shares highly tested and robust common modules to guarantee consistency of operation and overall product reliability.

Power Levels

The family release boasts seven power levels to cover the power range and performance requirements of even the most demanding application. Two stepper power levels from five to eight Amps peak per phase at 170 Volts DC bus. Five servo power levels ranging from three to 20 Amperes continuous motor current at 100 to 400 Volts DC bus, with future plans for higher power versions. Most servo versions feature a universal power input 85VAC to 264VAC to truly meet the requirements of today's global marketplace. All versions include built in regenerative power dump to maximize motor dynamics without the need for additional external hardware. There's even a low power servo amplifier specifically designed to minimize motor heating while maximizing dynamics of high performance, super low inductance motors and linear servo motors.

Controller Intelligence

Three levels of control, each adding motion and machine control complexity over and above the level below.
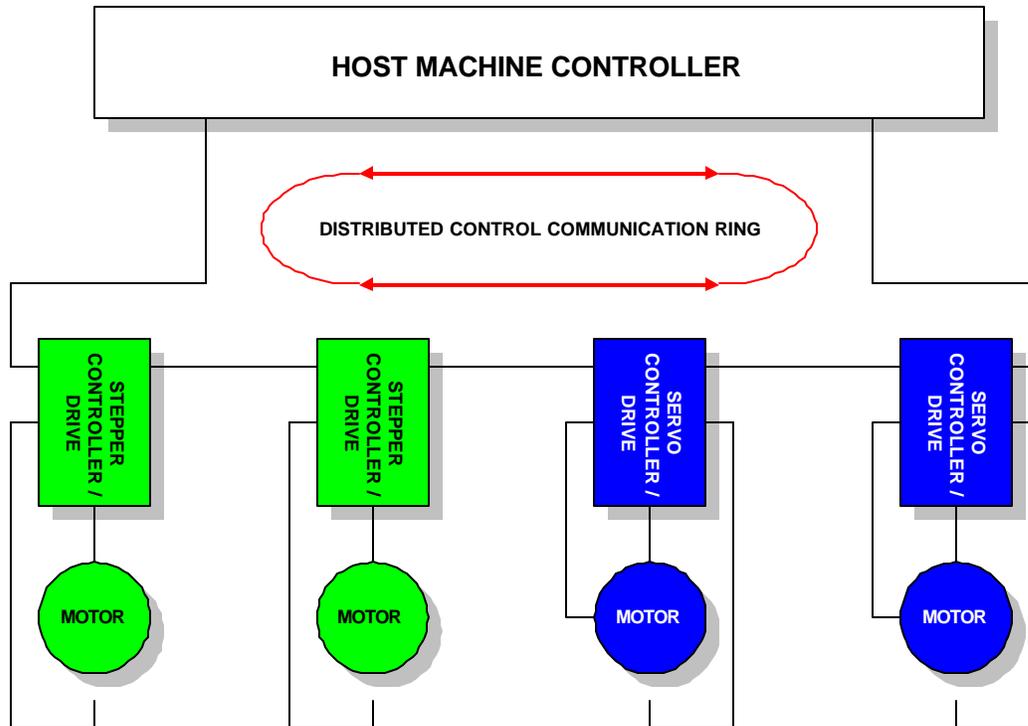
1. High-end controller/drives
2. Base controller/drives
3. Digital drives

Levels of Control

The Gemini product family consists of three levels of integrated control, allowing your application needs to be met exactly. The base level digital servo and stepper drives are designed for use with an external motion controller, both servo (GV) and stepper (GT) version accept industry standard digital step and direction pulse trains for motion command and the traditional ±10 Volt command. Designed to interface with a master controller, the base level drives form the follower axes of traditional machines. A central intelligent controller sends pulse trains or analog commands to these "traditional" drive products, which in turn carry out the low level motion instruction. Machines with multiple axes could benefit from a single multi-axis controller and numerous "traditional" drives, as machine coordination is central to the controller.
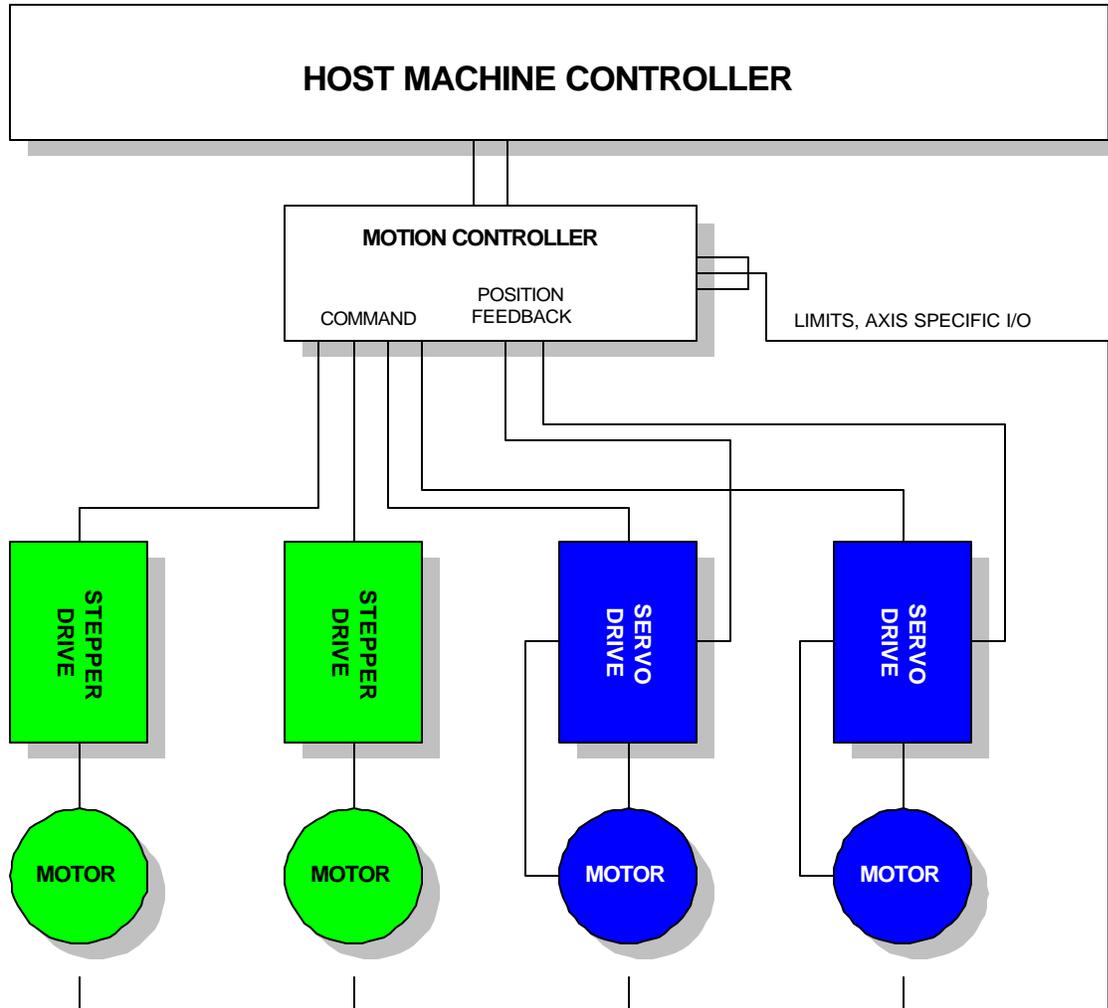
The next level of integration is the base controller/drive. This topology offers the addition of a reduced instruction set command language consistent with current Parker offerings. The GT6 and GV6 have basic homing, registration, s-curve and tiered motion profiling functionality. Sequence storage capability adds powerful programming options, while program flow-control consists of simple logic, wait conditions and looping. Each controller/drive has eight digital inputs and six digital outputs available to interface with local limit switches or process control switches. Simple digital I/O or field bus can be used to coordinate or oversee the controller drives, for true distributed motion control. PC control via RS232C and RS485 is standard, while advanced controller to drive communication is offered through the optional SERCOS interface.

HOST MACHINE CONTROLLER

DISTRIBUTED CONTROL COMMUNICATION RING

STEPPER CONTROLLER / DRIVE

STEPPER CONTROLLER / DRIVE

SERVO CONTROLLER / DRIVE

SERVO CONTROLLER / DRIVE

MOTOR

MOTOR

MOTOR

MOTOR

LIMIT SWITCHES AND OTHER AXIS SPECIFIC PROCESS CONTROL IS HANDLED BY THE LOCAL CONTROLLER / DRIVE

The third tier of control intelligence integration is in the high-end controller/drive. These drive products come equipped with a powerful command language specifically designed for solving even the most demanding of motion control tasks. The GT6K and GV6K are capable of complex motion such as contouring, multitasking and following, yet boast a simple mnemonic language. Applications requiring ultimate programming flexibility can make use of this powerful combination.

Connectivity

In an industry where new communication protocols seem to appear on a daily basis, it's nice to know you have options. Traditional serial communication schemes such as RS232C and RS485 come standard with all products in the family, while other industry standard protocols are optionally available. Future plans include the addition of Ethernet connectivity, DeviceNet, Profibus and SERCOS.

Bridging the Gap

In order to survive, we must change the rules of the industry, tear down the technological barriers that stand in the way of the optimum solution. The Gemini family does just this. It gives machine designers the choice of power and technology, while maintaining a common hardware and software platform.

Traditionally, the application of specific motor technologies has been well defined. For instance, requirements for closed loop positioning, high acceleration rates and fast settling

times dictated the use of servo technology, while high resolution and low cost meant a stepper solution. If the application demanded both technologies it meant two distinct products types, or even worse, products from two different manufactures attempting to work together. This lack of continuity in product offering has made machine design problematic, as a single source dual-technology solution didn't exist. With the Gemini family, customer need only learn one piece of hardware and one piece of software to configure and use the entire product line.

Innovative, Cost-Saving Motion Technology

This includes Active Damping™, Electronic Viscosity™, ABS Damping™, Encoderless Stall Detect™, Pocket Motion Planner™. Details follow.

New Motor Technology

Servo Technology -
- Auto-configuration for motor and load allows the user to select a motor from a database and download all relevant motor parameters to the drive in a quick and efficiently manner. This greatly reduces drive setup time and removes the chance for mis-entered data. User motor data can also be stored for later retrieval. (maybe show the utility screen capture)
- Digital notch filters selectively defeat mechanical resonance common with shaft couplers, long linear stages and compliant transmissions. This allows the systems to maintain high gain values (for responsiveness) without the fear of mechanical oscillation.
- Intuitive tuning algorithm, the user need only know two additional system parameters, load inertia and bandwidth. The load inertia is known to varying degrees from the machine design and motor sizing exercise that was done prior to drive and motor specification. This leaves system bandwidth as the only unknown. An estimated value for this parameter is entered, and the machine made to run. If the machine responsiveness is sluggish, the bandwidth is increased, if too responsive, decreased. System tuning could not be simpler. Of course those machines builders in need of optimum performance can also specify system damping and other high level terms.
- Multiple gain sets are available to allow the user to maximize performance during all parts of the machine cycle. No longer must performance be sacrificed to account for changing load conditions.

Stepper Technology -
Digital implementations of innovative control technology introduced in the ZETA family of stepper drives, and more! New features that make your job simpler.
- Active Damping™ a highly aggressive resonance damping algorithm that greatly increases step-motor stability and responsiveness while reducing settling time. Torque margins can be reduced to 10%, allowing machine builders to reduce motor size and cost. Settling time-induced dwells can be all but eliminated from

machine cycles for greatly increased throughput. Adjustable gain sets allow optimization for machines with dynamic load conditions.

- Electronic Viscosity™ a friction-less (non-mechanical) solution to damping at low speed. Greatly reduces end of move settling time, the rotor settles orders-of-magnitude faster than with conventional step-motor technology. Application afterthoughts like inertial seismic dampers and friction rings are a thing of the past.
- ABS Damping™ a "load independent" purely electronic means for damping oscillation at rest. Like electronic viscosity, ABS damping greatly reduces end-of-move (zero speed) settling time, allowing tremendous reduction in cycle times for pick and place type applications. No more waiting for the load to settle.
- Encoderless Stall Detect™ removes the need for an optical encoder or other mechanically sensitive feedback device as a means for stall detection. Historically, the open-loop nature of step-motor systems has greatly limited the scope of their use. This new technology allows for reliable stall detection without the added cost or complexity of any feedback device. In many applications, low-cost servo systems have been specified into traditional stepper rolls, merely for the security of position verification. No longer are machine designers forced away from the low cost, rugged solution.

Ready, Set, Go!

To ease the task of setup, Parker has introduced Motion Planner and Pocket Motion Planner, the industry's first Windows CE-based drive configuration utility. These software packages not only allow programming and retrieval of all drive parameters, but allow graphical facilitation of servo tuning, motion profiles and system response measurements. Both versions of Motion Planner feature a terminal emulator, for direct communication to the Gemini family, a pull down menu based configuration tool for quick and reliable setup, a quick update status tool for diagnostics and troubleshooting and a 6000 to Gemini to 6000 language translation utility.

Motion Planner is designed for the desktop PC, while Pocket Motion Planner is a hand-held personal computer utility specifically designed to run on low cost Windows CE based portable palmtop computers.

Motion Planner contains powerful wizards to help make programming a snap, while Pocket Motion Planner removes the need for product specific pendants or other functionally limited interrogation hardware by allowing full configuration and diagnostics from the convenience of the factory floor.
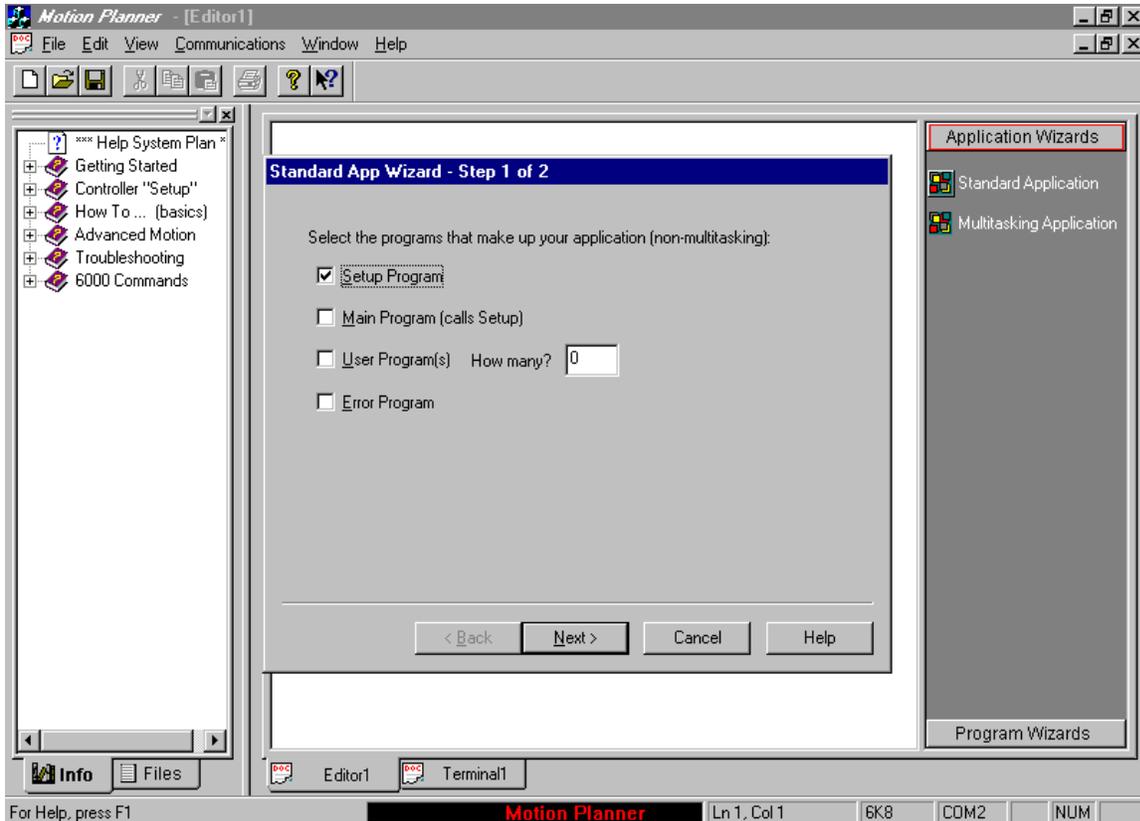
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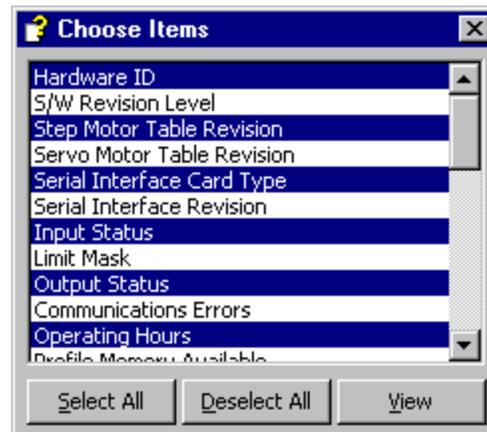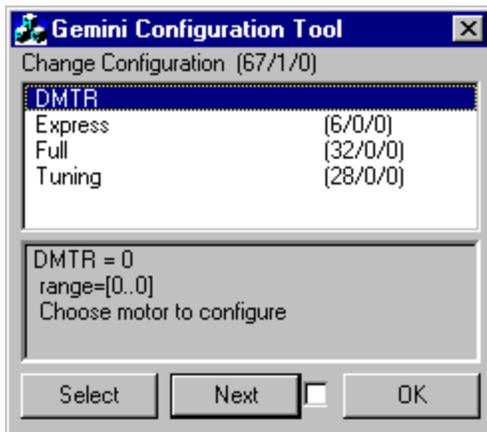
Shown above are Pocket Motion Planner configuration and status tool

A real time saver, the Motion Planner Status Tool, allows quick and efficient troubleshooting of all drive parameters. Simply highlight the information of interest from the scroll bar menu, and the information is retrieved and continually updated in near real time. Parameters such as inputs, outputs, current axis condition and much more are right at your fingertips. To facilitate troubleshooting of non repetitive, "random" events, there's even a text log, which holds the last 10 system errors. Finally, an integrated communication, configuration and troubleshooting utility with an intuitive, user friendly interface.

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Simplified machine maintenance and application troubleshooting is facilitated by optional utilization of the 24V keep alive input. This hardware function allows removal of high voltage from the product, while keeping the drive intelligence alive and communications on-line. No more lost position, status or fault information. After all, time is money.

Rigorous hardware and software testing during all levels of design ensure a sound product. Full electromagnetic compatibility guarantees a non-intrusive and industrial robust solution for today's motion control needs.