

New Galil Controller and Drive for Single-Axis Applications

Galil announces their new CDS-3310 controller and drive system designed for precisely controlling a single brush or brushless servo motor. The new controller is ideal for single-axis applications that require high-performance, low-cost and reduced wiring. The CDS-3310 combines a programmable motion controller and 500-Watt drive into a single, compact package that eliminates the external wiring between the controller and drive.

The CDS-3310 provides many advanced, high performance features similar to Galil's popular DMC-21x3 multi-axis controller and drives, except that it has been cost-reduced for single-axis applications. Advanced features include PID compensation with notch filter and velocity/acceleration feedforward, non-volatile program memory with multitasking, uncommitted digital and analog I/O, and multiple modes of motion such as electronic gearing and teach-and-playback. It also accepts differential encoder inputs up to 12 MHz, and provides dual encoder inputs that enable the controller to easily accommodate electronic gearing or dual-loop applications.

Additionally, the CDS-3310 includes a high-performance PWM drive which operates up to 7 amps continuous, 60 Volts.



CDS-3310 Controller and Drive System

Software commands provide diagnostics and programmable amplifier gains, and also allow the drive to be easily configured for brushless or brush motors. The PWM switching frequency is 60 kHz and the amplifier offers protection against over-voltage, under-voltage, over-current, short-circuit and over-temperature scenarios. An onboard DC-to-DC converter allows for convenient voltage input from a

single 18V-60V DC supply. The CDS-3310 includes a 10/100 Base-T Ethernet port and RS232 port. Special software commands allow the CDS-3310 to operate in a distributed network where up to eight controllers can be linked. Communication overhead is minimized because the host computer needs only talk to the master CDS-3310 in the network which, in turn, communicates with the other controllers in the network.

Packaged in a compact 5.15" x 8.25" metal enclosure, the CDS-3310 controller and drive unit is priced at just \$495 in 100-unit quantity, making it very cost-effective for high-volume OEMs. Complete specifications and pricing can be viewed at <http://www.galilmc.com/products/econo/cds3310.html> or call Galil at 800-377-6329.

Galil Introduces

MotionCode™

Step-by-Step Solutions for Motion Applications

To help engineers better tackle their motion control challenges, Galil offers MotionCode, a newly developed, free design toolkit for step-by-step development and integration of motion applications. Currently, the toolkit is loaded with six, complete MotionCode solutions. Motion types solved include flying shear, gantry, pick-and-place, and more.

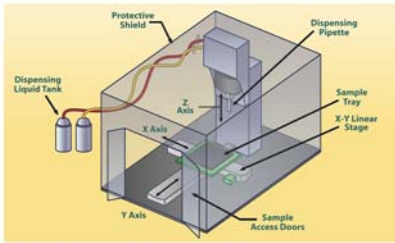
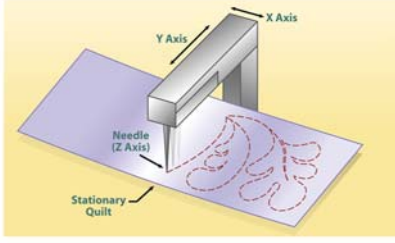
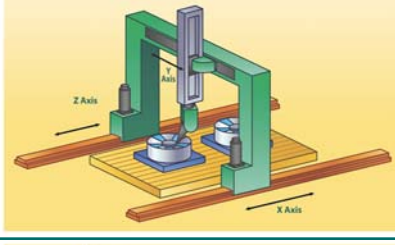
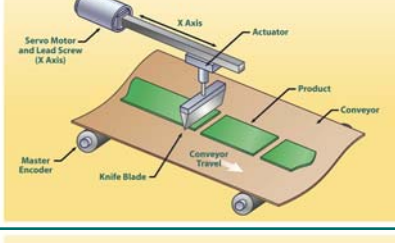
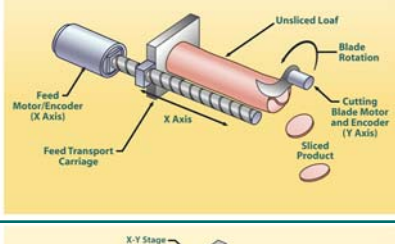
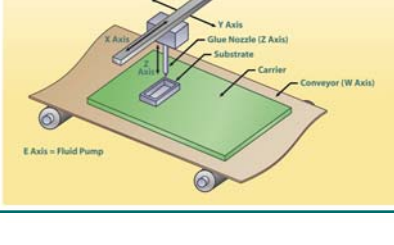
With each MotionCode solution, you'll find:

- Machine Description and Overview
- Summary of Motion Requirements
- Recommendations for Selecting Hardware
- Motion Programs
- Actual Downloadable Software Code

Already, Galil is developing more MotionCode solutions to add to its library, and will continue to add even more in the coming months. We invite you to view each solution at no cost at <http://www.galilmc.com/motioncode.html>

Galil's team of dedicated motion control specialists is ready to work with you to get maximum value from the MotionCode toolkit, and to ensure that your motion application is implemented with positive results.

Just call Galil at 800-377-6329, Monday-Friday, from 8am - 5pm PST.

MOTION	MACHINE		ALTERNATE USES
XYZ pick and place		DNA MICROARRAYER	Biotech, semiconductor packaging, food processing
XY vector motion w/ geared Z		AUTOMATED SEWING MACHINE	Textile, machine tools, semiconductor
XY cartesian gantry		WATERJET CUTTER	Machine tool, textiles, semiconductor
Linear flying shear		FABRIC MATERIAL CUTTING	Textile, packaging, food processing
Rotary flying shear		FOOD SLICING	Food processing packaging, textile
XY vector motion w/ geared Z		MATERIAL DISPENSING	Semiconductor, machine tools, textile

Sub-Micron Positioning Accuracy In A High Resolution System

by Todd Shearer, Senior Applications Engineer

Introduction

Many industries today, such as biotechnology and semiconductor, are introducing machines that require an ever increasing amount of accuracy and performance. Many of these applications are being designed around sub-micron positioning accuracy, with very demanding move and settle criteria. With these stringent requirements, it is up to the motion controller to accurately position and settle these moves.

A recent Galil customer application will be used to demonstrate this, using the Galil motion controller and amplifier in a high-resolution system. This particular application had two axes with 0.1µm resolution feedback, with very demanding move and settle times. Both the X and Y axes use linear motors with cross rolled slides.

Design criteria

Each axis was required to perform an incremental step move, pause for a short duration (<2msec) to analyze a sample, and then continue to the next step move. The goal of the test was to perform a single move and settle to within a specified distance as fast as possible.

Below are the customer specifications:

Specifications	X axis stage	Y axis stage
Total stage travel (mm):	23	11
axis payload (g):	750	340
Encoder resolution (µm):	0.1	0.1
Single step move (µm):	509	376
Settle position window (µm):	+/-0.3	+/-0.3
Move and settle required time (msec):	60	40

Components Used

Galil's DMC-2133 3-axis Ethernet motion controller and AMP-20540 PWM multi-axis drive were chosen for this application. The AMP-20540 attached directly to the controller, eliminating extra wiring. In addition to controlling the X and Y axes, the DMC-2133 3-axis controller was used to provide control of a lower performance Z-axis which is not discussed in this note. To meet the demands of high-resolution, the controller and amplifier were configured with the following options:

DMC-2133-FAST. The FAST firmware option on the Galil DMC-2133 controller allowed the minimum sample period of 250µsec to be set. This, in conjunction with the controller's 16-bit DAC, gave more than enough filter resolution to get optimum performance out of the stage axes.

AMP-20540-140kHz. The AMP-20540 was used with a special high frequency switching option, which increased the switching

frequency of the amplifier to 140kHz from the standard 60kHz. This gave the amplifier the ability to drive the motors with very little torque ripple, which is a necessity for high resolution systems.

Procedure

The procedure to get final optimum performance of this system consisted of two steps.

First, the amplifier gain had to be adjusted to match the controller and load. The +/-10V command signal (16-bit DAC) from the Galil controller should correspond to maximum and minimum current to the motor. Depending on the motor load and required acceleration, this peak value may actually be less than what the amplifier can provide.

The motors required only 5A at 24V for peak acceleration and deceleration. The AMP-20540-140kHz was capable of 7A continuous and 10A peak; much more than what was required. Through software, the gain of the amplifier was decreased to .7A/V, giving a peak of 7A. This allows the controller to utilize a larger range of its DAC output.

Second, the motion profile was adjusted and the PID filter tuned for optimum performance. Speeds, acceleration and decelerations needed to be selected for minimizing following error during the move. This, in conjunction with a well tuned PID filter, resulted in minimal settling time after completion of the move.

Using Galil's WSDK Storage Scope feature, rough filter parameters were found to give adequate performance of the system. These numbers were used to determine what type of profile (speed, acceleration and deceleration) gave the best blend of high speed and minimum following error. With those profile values determined, the system was re-tuned to give the final, optimal performance numbers for the system, as shown below:

Parameters	X axis stage	Y axis stage
Speed (counts/sec):	80,000	65,000
Acceleration (counts/sec ²):	1,150,000	1,500,000
Deceleration (counts/sec ²):	1,150,000	1,500,000
Derivative gain (KD):	750	200
Proportional gain (KP):	30	20
Integral gain (KI):	8	6
Integrator limit (IL):	1	9.9
Feedforward acceleration (FA):	4	2

Note: The above numbers do not reflect the FAST sample rate scaling of 250µsec from 1000µsec. For true speeds, multiply by 4. For true accelerations and decelerations, multiply by 16.

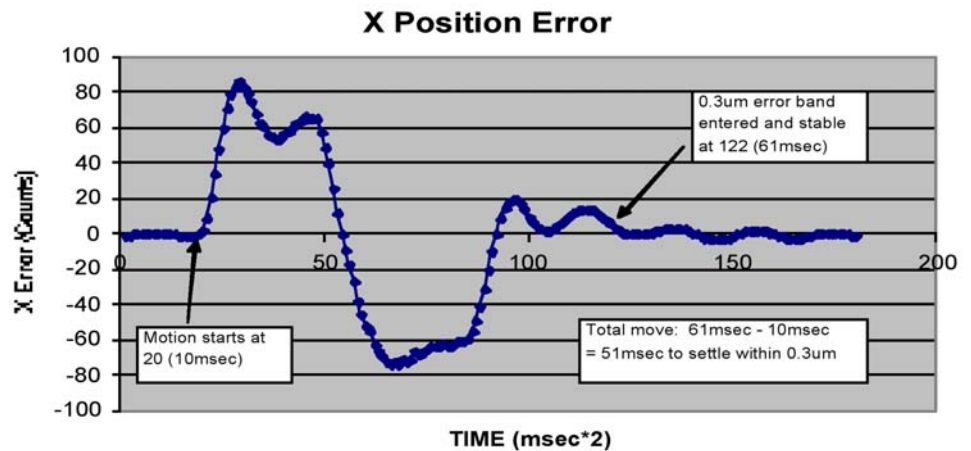
Performance data

Once the stage was tuned and profile parameters were determined, the final data was collected. The results of both axes step tests are shown below:
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Sub-Micron Positioning Accuracy (Continued from page 3)

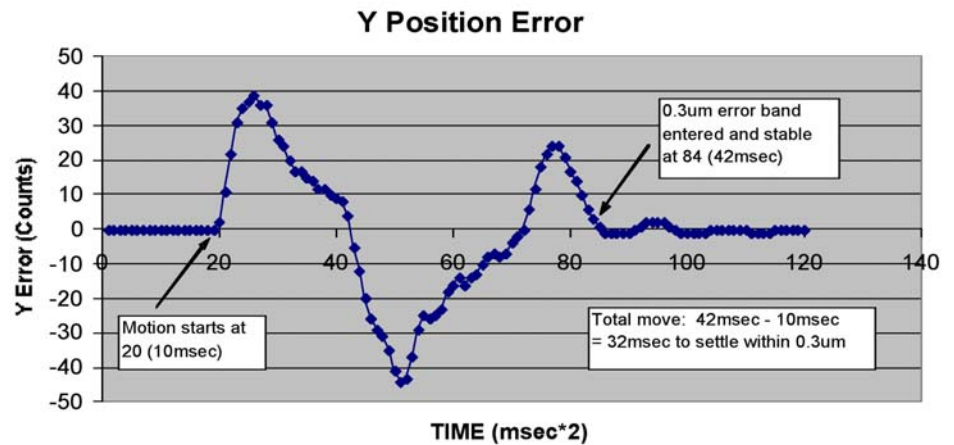
X axis single step and settle

On the X axis, the measured average single step and settle time was 52msec, versus the required time of 60msec. This is a 13% increase in performance from the customer specifications. The following graph shows one sample step and settle move:



Y axis single step and settle

On the Y axis, an average single step and settle time of 30msec was measured, versus the required time of 40msec. This is a 25% increase in performance from the customer specifications. The following graph shows one sample step and settle move:



Conclusion

The success of this application shows that the Galil controller and amplifier can give the high resolution performance demanded by many of today's applications. The values found for the PID filter are solidly in the middle of the controller range, which allow for flexibility should any changes be made on the system level. The controller could easily be fine tuned for any of these changes.

Can even better performance be attained in this application? Yes. The tuning and results shown were derived using the actual customer motors and slides, which were mounted on a desktop setup with unshielded wiring. Moving the motors to the final granite table, with shielded wiring would yield even better results and save, perhaps, another 5-10%.

“Live” Tech Support for Fast Answers to Your Questions

Galil has a full team of dedicated application engineers in residence and ready to support your project. They are motion control specialists, each personally trained by Jacob Tal, co-founder of Galil and renowned expert in motion control. To receive prompt service from a “live” Galil engineer, just call Galil at **800-377-6329** Mon-Fri 8am-5pm Pacific Standard Time. Or, email support@galilmc.com. They're at your service.

“The mission of Galil’s experienced Applications Department is to provide prompt and accurate technical assistance to help OEMs successfully deliver their products to market.”

Galil Technical Support Team

Top Row-left to right- Chris Richtsmeier, Chris Cortopassi, Robin Riley
3rd Row- left to right- Kaushal Shah (Group Mgr.), Glen Garrettson, Enoch Wall
2nd Row-left to right- Eric Kelley, Todd Shearer (northeast region)
Front- John Hayes



Count On Galil For *Unmatched* Support and Service

With each and every Galil controller you own, you can always count on Galil's passionate commitment to providing superior customer support. This includes:

- *A fully-trained technical support team with over 100 man years of motion control experience*
- *A content-rich website filled with a depth and breadth of educational information including application bulletins, white papers, recorded tutorials*
- *An interactive bulletin board with knowledge base*

From its very beginnings, Galil has provided a range of materials and venues for educating their customers about motion control, such as live seminars and programming workshops. In fact, over 10,000 engineers have attended Galil's popular "Motion Control Made Easy" seminar, which is now available for viewing on video or the web.

Galil also has an extensive, ever-growing library of free web-tutorials that are available 24/7 to registered viewers. Currently, over twenty tutorial topics can be accessed, including servo tuning, motion programming, motor and drive technology, and more.

Now, Galil takes its support up yet another notch with MotionCode, a brand new, free toolkit that provides several step-by-step solutions to help customers quickly solve their motion applications. Each MotionCode solution includes an application description, component selection guidelines, and downloadable software.

To discuss your motion project, contact Galil's tech support team at 800-377-6329. Don't forget to check-out Galil's online resources at www.galilmc.com, including the following popular links:

Live Seminars and Programming Workshops

<http://www.galilmc.com/training/seminars.html>

White Papers and Application Bulletins

<http://www.galilmc.com/literature/technotes.html>

Library of Recorded Web-Tutorials

<http://www.galilmc.com/training/webconf.html>

Bulletin Board with Knowledge Base

<http://www.galilmc.com/support/index.html>

Motion Control Textbook and Video

<http://www.galilmc.com/support/library/textbook.html>

MotionCode™ Step-by-Step Solutions for Motion Applications

<http://www.galilmc.com/motioncode.html>

From some of our well-supported customers:

"I work with many manufacturers in my role as controls systems designer and have yet to find a company that provides us with the level of professional support that your company does. From the receptionist that takes my calls to the knowledgeable people on your technical support team, your people are top notch and professional."

— Dennis at Wright Machine Tool

"We were experiencing a very frustrating problem and called Galil for assistance. You helped us isolate the problem and send back a solution. Throughout the process, you were very responsive, helpful, and polite. Most importantly, you solved the problem. In short, this is the most impressed I've ever been with a tech support experience."

— Bob at Prototechautomation

"I was impressed with your support team and their willingness to correct, rather than deflect, the problem at hand."

— Todd at Zygo

"This was the first Galil controller I have purchased. I'll tell you the Galil was so easy to use, I don't have any questions"

— Troy at US Grinding

"I just placed my first order yesterday and I will say that your tech support team was outstanding and helped guide me to a purchase."

— Perry at Rockwell Collins



"The mission of Galil's experienced Applications Department is to provide prompt and accurate technical assistance to help OEMs successfully deliver their products to market"

Galil. We Move the World.

With over 350,000 controllers installed worldwide, Galil is the #1 leading supplier of motion controllers. Galil's legacy of innovation began in 1983 when they introduced the first microprocessor-based servo motion controller. Today, Galil continues its leadership by offering the most powerful, cost-effective and easy-to-use motion controllers to accommodate all your motion needs.

Galil provides you with the widest choice of single or multi-axis, bus-based or stand-alone, and box-level or card-level controllers. Interface options include PCI, ISA, PC/104, VME, cPCI, USB, RS232 and Ethernet. Select from 1-, 2-, 3-, 4-, 5-, 6-, 7- and 8-axis controllers, and configure them to run stepper or servo motors on any combination of axes.

Additionally, Galil provides various accessories that enable you to complete your project quickly. These include servo motors, amplifiers and software tools for quick set-up and "one-button" servo tuning.

Motion Controllers – PCI

DMC-18x0. PCI, 1-8 axes

DMC-18x2. PCI, 1-4 axes

DMC-1417. PCI, 1 axis

Motion Controllers – Ethernet/RS232

DMC-20x0. USB/RS232, 1-8 axes

DMC-22x0. Ethernet/RS232, 1-8 axes

DMC-21x2/x3. Ethernet/RS232, 1-8 axes

CDS-3310. Ethernet/RS232, 1 axis controller and servo drive unit

DMC-14x5. Ethernet/RS232, 1-2 axes

DMC-34x5. Ethernet/RS232, 1-2 axes

IOC-7007. Ethernet I/O controller

Motion Controllers – Other

DMC-12x0. PC-104, 1-8 axes

DMC-13x8. VME, 1-4 axes

DMC-16x0. cPCI, 1-4 axes

DMC-17x0. ISA, 1-8 axes

DMC-1410. ISA, 1 axis

DMC-1411. PC/104, 1 axis

DMC-1412. RS232, 1 axis

Plug-In, Multi-axis Drives

AMP-20341. 4 axis, 20W servo drives

AMP-204x0. 2 & 4 axis, 200W servo drives

AMP-205x0. 2 & 4 axis, 500W servo drives

SDM-20240. 4 axis, full/half stepper drives

SDM-206x0. 2 & 4 axis, microstep drives

Software Tools

Communication Drivers. For DOS, QNX, Linux and all current versions of Windows

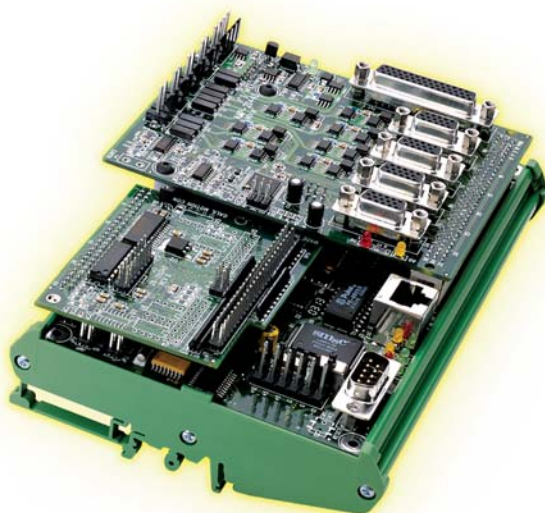
SmartTerm. Provides a friendly interface to all Galil controllers

WSDK. Servo Tuning and analysis software

ActiveX Toolkit. Custom controls for Visual Basic or other ActiveX software

CAD-to-DMC. Translates AutoCAD DXF files into DMC controller files

For complete specifications and pricing on all Galil products, please go to www.galilmc.com
Request a free catalog at <http://www.galilmc.com/products/catalog.html>.



Galil's DMC-21x3 multi-axis motion controller with plug-in drives eliminates extra cabling and reduces cost.