

# ServoTRENDS

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## GALIL INTRODUCES THE DMC-2000 SERIES—THE FIRST MOTION CONTROLLER DESIGNED FOR THE USB

**G**alil Motion Control, Inc. continues to pioneer new digital motion control technology by introducing their DMC-2000 stand-alone motion controllers—the first ever to be available for the Universal Serial Bus (USB). The series is available in 1-through 8-axis formats and allows control of both step and servo motors on any combination of axes.



USB is a serial bus standard developed by PC and telecom industry leaders such as Compaq, IBM, Intel and Microsoft. USB peripherals simply attach to USB ports on the PC, eliminating the need to install cards into dedicated computer slots. Thus, USB equipped PCs will allow computer peripherals to be automatically configured as soon as they are physically connected without the need to reboot or run setup programs.

The DMC-2000 provides the user

with a variety of communication options including the new USB (12Mb/sec, expansion hub with two ports) and two RS232/RS422 ports configurable up to 115Kb. A variety of software is available for quick and easy set-up, automatic servo tuning and interface with ActiveX™ tools. There is also software available for DOS, Windows™ 3.1, 95, 98, and NT as well as a complete library of function calls for C/C++ programmers.

The DMC-2000 provides non-volatile memory for application programs, variables and arrays which permits operation without a host computer. Other features include multitasking for allowing simultaneous execution of up to eight application programs.

The DMC-2000 includes such standard features as sinusoidal commutation for brushless motors, two encoder inputs for each axis, 96 configurable I/O, and optoisolated forward and reverse limits and home inputs for each axis. Modes of motion include independent axis positioning, linear and circular interpolation, contouring, electronic gearing and ecam. The DMC-2000 will also allow multiple sets of coordinated axes to operate simultaneously. Encoder frequencies of up to 12 MHz are accepted.

For detailed specifications on the new DMC-2000 Series, contact Galil at 800-377-6329 or send in the reply card.

### WHY THE USB IS SO IMPORTANT

Connectivity is as much an issue in motion control as it is in factory automation. It's a basic that people look for to:

- ensure fast communication between the host computer and the controller
- ease communication with the motion controller and other devices such as PLCs from the same program
- minimize wire length
- establish universal standards

As Jacob Tal, president of Galil, says, "For six to eight years, vendors have been trying to set up a network to eliminate expensive wiring and the magnetic noise picked up by encoder wires. SERCOS and other European buses have become popular in the United States, but other companies have adopted DeviceNet. When Microsoft recently adopted the Universal Serial Bus (USB), every computer company followed."

Tal adds, "Because USB is a low cost, high performance, high reliability bus with industry-wide backing, it is certain to become a standard machine bus. Most of the growth of the USB will be from migration of the ISA, PCI and proprietary bus users."

# SPOTLIGHT ON ROBODESIGN

For the best in systems integration that involves Galil technology, consider RoboDesign International, Inc. of Carlsbad, CA., a dynamic company capable of automating virtually any industry process to significantly improve system productivity. This full service engineering company not only specializes in automation engineering and process control, it is fully knowledgeable of Galil's full line of motion control products, software (including ActiveX toolkit) and applications.

In fact, RoboDesign uses Galil controllers for virtually all of their customer applications. Brian Ganz, President/CEO of RoboDesign International, Inc., explains, "Integrating Galil controllers gives our designs the flexible, technologically advanced edge required to meet the demanding motion control requirements of our customers."

RoboDesign has numerous, successful installations of Galil products. Two of these include Shotmaker, Inc., and Kaynar Technologies, Inc. For Shotmaker of Hollywood, CA,

Tag	Parameter	Value	Units	Default
PXSTN1	X Arm Position to STATION 1	0.00	cnts	0.
PXSTN2	X Arm Position to STATION 2	30000.00	cnts	30000
PXSTN3	X Arm Position to STATION 3	63600.00	cnts	63667
PXSTN3B	Station 3 Secondary Position	63600.00	cnts	63667
PXSTN4	X Arm Position to STATION 4	80025.00	cnts	80000
PYLIDUP1	Y COVER vert-axis up to engage gri	37000.00	cnts	-24000
PYLIDUP2	Y COVER vert-axis up to engage C	33700.00	cnts	-19000
PYLDDWN	Y COVER vert-axis down without C	-2480.00	cnts	0.
ZYGEAR	Y COVER vert-axis down at COVER	0.01	cnts	4.17e-002
PZRESCRWZ	COVER rot-axis re-screw COVER	360000.00	cnts	-240000
PZUNSCRWZ	COVER rot-axis unscrew COVER	-255000.00	cnts	240000
PZRSBACK	Unscrew COVER after Torque	-20000.00	cnts	-20000

*RoboDesign's custom MMI for the Galil controller.*

RoboDesign developed a remote movie camera platform using a Galil DMC-1760 six-axis motion controller. For Kaynar Technologies of Fullerton, CA., they integrated a Galil DMC-1730 three-axis controller into a screw thread coil-winding machine. The machine

accelerated Kaynar's production to a rate of 20 parts per minute and allowed computer-controlled change of any part number.

For excellent systems integration, contact RoboDesign at **760-438-5282** or [www.robodesign.com](http://www.robodesign.com).



## ASK JACOB TAL

*Jacob is an industry pioneer and acclaimed lecturer in motion control. Following are some typical questions he routinely answers for engineers:*

**Q.** *Can the motion controller perform traditional PLC functions?*

**A.** Yes. Motion controllers often include user-programmable inputs and outputs that can be used to perform traditional PLC functions. For exam-

ple, Galil's DMC-2000 controller includes 80 programmable I/O.

**Q.** *If a machine requires motion control and PLC functions, should the motion controller do the PLC functions or should the PLC perform the motion?*

**A.** It all depends on the requirements. If the motion is simple and involves open loop control or the motion is not precise, it can be done easily by a PLC. If the motion is complex or requires precision, it requires a motion

controller. If the system requires precise motion and a very large number of inputs and outputs, both a motion controller and a PLC may be required.

**Q.** *Is it possible to operate both a PLC and a motion controller from the same program?*

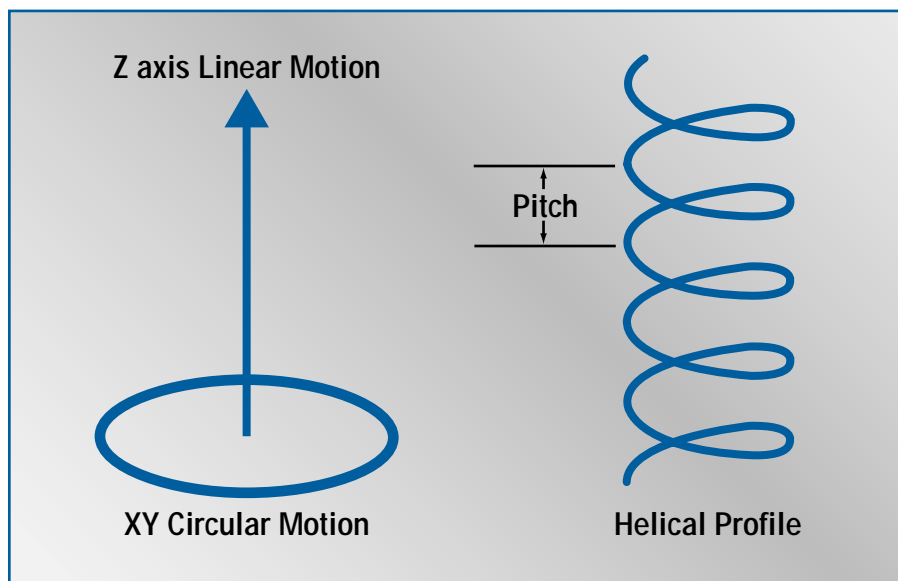
**A.** Yes. There are several software packages, such as Think and Do and ASAP which operate an Input/Output card and a Galil Controller from the same program.

# NEW C FUNCTIONS SPEED DEVELOPMENT

Galil has recently expanded its library of C functions, enabling C-programmers to create complex motion profiles without having to spend time learning the Galil Instruction Set.

lated ahead of time. The calculations must be repeated each time a new helix is generated, making it difficult and time consuming to optimize the path.

Until now, the user has been bur-



For example, the DMCHelix function creates an output file to generate a helical motion path. Such paths are often used in CNC milling applications for cutting threads or for tool approaches where a simple Z axis tool plunge is undesirable. Using a Galil controller, you can generate helical motion by electronically gearing a coordinated (2 axis) circular motion with a linear motion perpendicular to the plane of the circle (see figure). The required gear ratio is determined by the desired pitch of the helix:

$$\text{Ratio} = \text{Pitch} / (2 * \text{PI} * \text{Radius}).$$

There is one limitation to the gearing approach: the derived gear ratio is usually a non-integer value less than one. Round-off errors will result since the controller has a fractional resolution of 1/65536. This rounding causes position error to accumulate over the length of the helix. To compensate for this error, the round-off error is calcu-

lated with performing the calculations required to generate the correct profile. However, with Galil's new DMCHelix function, the entire procedure is automated. Now, a helical profile can be generated with the following simple function call:

```
rc = DMCHelix('X', 'Y', 'Z',  
Pitch, Radius, Start_Angle, Distance,  
Speed, Accel, Decel, "helix.dmc");
```

Galil has a complete library of C functions to help you solve your motion problems. New functions include:

- Ellipse
- Spline
- S-Curve
- Autotune

Call Galil at 800-377-6329 with your motion requests. Our team of experienced C-programmers can create custom C functions for your specific motion requirement.

## GET YOUR SERVOTRENDS E-MAILED IN 1999

Beginning in 1999, ServoTrends, Galil's quarterly newsletter, and Galil seminar announcements, will be available via electronic mail. If you desire, Galil will deliver ServoTrends to your e-mail address to assure rapid delivery while saving a tree in the process. Please fax or mail-in the enclosed reply card to start e-mail service with the next issue of ServoTrends. You can also let us know if you prefer to continue to receive the printed version in the mail. Either way, you need to send in the BRC to ensure continued delivery of ServoTrends in 1999.

## FIRMWARE AND SOFTWARE DOWNLOADS

Now, you can download the latest firmware versions for the DMC-1200, DMC-1600, DMC-1700 and DMC-2000 from Galil's FTP site accessed at [www.galilmc.com](http://www.galilmc.com). The latest revisions are listed in the Readme file. DMCWIN and DMCDOS can also be downloaded from this site at no charge. Call Galil at 800-377-6329 if you have any questions.

# STANDARD FEATURES OF GALIL CONTROLLERS

- Uses a 32-bit microcomputer for highest performance and speed
- Includes linear and circular interpolation, electronic gearing, ecam and contouring—*solves any motion task*
- Configurable by user for step or servo motors on any combination of axes—*flexible*
- Up to 8-axes of control from a single controller—*buy just the number of axes you need*
- On-board memory for application programs, variables and arrays—*frees host computer*
- Multitasking for simultaneous execution of up to 8 application programs
- 12 Mhz maximum encoder frequency; 3Mhz maximum stepper frequency—*high speed*
- Uncommitted digital I/O and 8 analog inputs—*eliminates PLCs*
- Accepts two encoders for each axis—*dual loop control for no additional cost*
- English-like, two-letter command set—*easy to program*
- Free C-programmers tool kit—*easy development in C/C++ environment*
- Software for DOS, QNX, Windows 3.1, 95, 98 and NT
- Available WSDK software for set-up, autotuning and motion analysis—*storage scope displays motion*
- Available ActiveX Tool kit—*quick development with Visual Basic*
- As low as \$100 per axis in 1000 quantity—*Cost-effective for OEMs*

## DELIVERING THE BEST VALUE IN MOTION CONTROL

**Galil Motion Control provides the best value in high performance motion controllers by guaranteeing the industry's lowest prices in minimum quantities of 100. Galil controllers are ready for a wide range of applications from simple point-to-point positioning to complex coordinated motion using multiple axes. The product line is comprised of packaged, industrial controllers; advanced, multi-axis card-level controllers; and economical, single-axis controllers. Galil also provides accessories that enable you to complete your project quickly. These include software design tools for quick and easy setup, tuning and analysis; and servo amplifiers, motors and encoders. With over 200,000 controllers in the field, Galil is truly the leading supplier of motion controllers.**

### Optima Series-Highest Performance

*DMC-2000 Series. USB, RS232*  
Standalone controller, 1-8 axes.  
Non-volatile memory, multitasking,  
96 configurable I/O, sinusoidal  
commutation.

*DMC-1700 Series. ISA bus.*  
1-8 axes, I/O expansion, memory,  
DMA.

*DMC-1600 Series. Compact PCI bus.*  
1-4 axes, 80 I/O, memory,  
multitasking.

*DMC-1200 Series. PC/104 bus.*  
1-8 axes, I/O, memory.

### Econo Series-Single Axis Controllers

*DMC-1410. ISA bus.*  
1-axis, electronic gearing and I/O.

*DMC-1411. PC/104 bus.*  
1-axis, electronic gearing and I/O.

*DMC-1412. RS-232.*  
Standalone controller, 1-axis, avail-  
able in an enclosure with a power  
supply. Electronic gearing and I/O.

### Legacy Series

*DMC-1000 Series. ISA bus.*  
1-8 axes.

*DMC-1300 Series. VME bus.*  
1-8 axes, dual port RAM.

*DMC-1500 Series. RS232.*  
Standalone control. 1-8 axes.

### Software Tools

*DMCWIN and DMCDOS.* Drivers  
for DOS, Windows 3.X, 95, 98 and  
NT. Includes terminal emulator.

*WSDK.* Servo tuning and analysis  
software including a 4-channel stor-  
age scope for display of motion.

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

*C-Programmers Toolkit.* Provides  
the flexibility and control of pro-  
gramming in C/C++. C libraries  
and functions.

*CAD-to-DMC Translator.* Designed  
to translate an AutoCAD DXF file  
into a DMC controller file.