



**QUARTERLY NEWSLETTER
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GALIL MOTION CONTROL**

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“ 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 SUPPORT TEAM



SERVO TRENDS

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RIO-47202 PLC

New Expanded Memory Option for RIO-472xx with Screw-Terminals

Galil’s RIO Pocket PLC is a smart, compact and low-cost Ethernet controller that is packed with I/O. Now, Galil announces a new addition to its popular RIO-47xxx PLC Series: The RIO-47202 with screw terminals and expanded memory.

RIO-47202 with Memory Expansion:
The RIO-47202 PLC is the same as the RIO-47200 with screw terminals except that it offers more memory, variables, array elements, programmable PID control loops and Ethernet handles. **Table 1** shows the expanded capabilities.

►(cont. pg 2)

Table 1: Comparison of RIO-47202 and RIO-47200

Number of:	RIO-47202 Expanded Memory	RIO-47200 Standard
Program Memory Lines	400	200
Symbolic Variables	254	126
Array Elements	1000	400
PID Control Loops	6	2
Ethernet Handles	5	3

The RIO-47202 PLC is ideal for customers that require more space for application programs or need to use additional variables or arrays in their programs. It also offers more PID process loops, which are ideal for temperature control.

The RIO-47202 PLC features the same packaging as the RIO-47200 which has DIN rail mount and screw terminals. This packaging differs from the RIO-471xx which provides d-type connectors. The various options for the complete RIO family are shown in **Table 2** below. See <http://www.galilmc.com/products/rio-47xxx.php> for complete specifications. ■



RIO-471xx
with d-type
connectors

Table 2: RIO Options

	# Digital Inputs/Outputs	# Analog Inputs/Outputs	Analog Resolution	Memory	Connectors & Dimensions
RIO-47100	16/16, 8 outputs are high power	8/8 (0-5V)	12-bits	200 lines, 126 var, 400 array	d-type 3.88x 4.26 x 1.3"
RIO-47120	16/16, 8 outputs are high power	8/8 (0-5V, 0-10,+/-10,+/-5)	12-bits std, 16-bits opt.	200 lines, 126 var, 400 array	d-type 3.88x 4.26 x 1.3"
RIO-47102	16/16, 8 outputs are high power	8/8 (0-5V)	12-bits	400 lines, 254 var, 1000 array	d-type 3.88x 4.26 x 1.3"
RIO-47122	16/16, 8 outputs are high power	8/8 (0-5V, 0-10,+/-10,+/-5)	12-bits std, 16-bits opt.	400 lines, 254 var, 1000 array	d-type 3.88x 4.26 x 1.3"
RIO-47200	16/16, all outputs are high power	8 inputs (0-5V) (analog outputs and 0-10, +/-10, +/-5V optional)	12-bits std, 16-bits opt.	200 lines, 126 var, 400 array	Screw terminals 7.19 x 3.52"
RIO-47202	16/16, all outputs are high power	8 inputs (0-5V) (analog outputs and 0-10, +/-10, +/-5V optional)	12-bits std, 16-bits opt.	400 lines, 254 var, 1000 array	Screw terminals 7.19 x 3.52"

BiSS Encoder Interface Options for Galil Motion and I/O Controllers

This article discusses the basic options for using a BiSS encoder with a Galil controller or Pocket PLC.

The Galil BiSS interface is a standard upgrade option for the following controllers:

- **DMC-40x0** 10/100Base-T Ethernet/RS232 Accelera Series 1-8 axis
- **DMC-41x3** 10/100Base-T Ethernet/USB Econo Series 1-8 axis
- **DMC-21x3** 10Base-T Ethernet/RS232 Econo Series 1-8 axis
- **RIO-47xxx** 10/100Base-T Ethernet Intelligent I/O Controller
- **DMC-18x6** PCI Accelera Series 1-8 axis
- **DMC-18x2** PCI Econo Series 1-4 axis
- **CDS-3310** 10/100Base-T Ethernet/RS232 1 axis controller with 500W servo drive

Galil supports a point to point unidirectional BiSS interface. Each BiSS encoder is wired directly to the Galil controller, and the controller addresses each individual encoder independently.

Galil supports single-turn and multi-turn rotary and linear absolute encoders from the following companies for a \$100 adder/4axis to the standard ICM or DB-28040 and a \$75 adder for the RIO. Use the part number -BiSS when ordering.

- *Hengstler Absolute BiSS encoders (AD/AC series)*
- *Renishaw Resolute*

If your encoder is not on the above list, please contact Galil to speak with an Application Engineer to discuss your application. For more information on the BiSS protocol, see: <http://www.biss-ic.de/> ■

New, 2-Minute Video: “Using the GalilTools Scope to Help Tune a Servo Motor”

Galil recently added a 2-minute video to its growing library of technical “how-to” videos. The latest video details how to easily tune servo systems using the scope provided by GalilTools software. The system components used in the video demonstration are Galil’s DMC-4010 Accelera motion controller and drive connected to a servo motor with encoder and a PC running GalilTools software.

The video shows how to use the GalilTools scope as an aid to properly tune a servo system. The scope tool allows the user to easily view and measure the system step response and adjust the PID tuning parameters until the optimum performance is observed. The video shows useful features of the scope such as data recording, triggering and the scope overlay with cursor. ■

Galil’s library of informative videos presents solutions to common motion and I/O problems. Perfect for busy engineers, these technical tutorials are two minutes each. The tutorials can be accessed at no charge, 24/7, at <http://www.galilmc.com/learning/two-minute-videos.php>

Current Videos

- “Using the GalilTools Scope to Help Tune a Servo Motor”
- “Establishing Communication with a Galil Controller using GalilTools Software”
- “Achieving Precise Temperature Control of a Liquid using RIO Pocket PLC”
- “Smooth Multi-Axis Motion through Arbitrary Points using PVT Mode”
- “Introduction to the Accelera Motion Controller Series”
- “Introduction to the RIO Pocket PLC”

Galil’s DMC-2143 Controls Flight Simulator for the Youth in Aviation Programs

When Riccardo Cardona, a pilot and retired mechanical engineer for General Telecom, met with Leroy Gillaid, one of the original WWII Tuskegee airmen and now 90 years young, it was love at first flight.

Both have a lifelong love affair with flying, and they show their passion for it by keeping the dreams alive for aspiring aviators by supporting Youth in Aviation programs (YIA). This includes the Eagle Flight Squadron, Inc., a nonprofit flight school located “in the middle of a very tough New Jersey neighborhood.”

“For the most part, the school is free to any youth who chooses a constructive path over the many urban pitfalls that surround them,” said Cardona. Not only does the school provide flight instruction, it offers career development, social interaction and a keen appreciation for discipline.

However, with funds lacking and the expense of flying soaring, the survivability of YIA programs like Eagle Flight Squadron is in question. There’s also the problem and inherent cost of having too many students enroll in the program and then drop out for various reasons—even after logging 5–7 hours of actual flight time and many hours of classroom instruction.

Cardona and Gillaid discussed using a flight simulator to reduce the cost of flying real airplanes—and to weed out those who are likely to not stick with the program for its duration. The problem is that a simulator can cost as much as \$1 million.

Luckily, as part of the Newark’s Northern Fairmount Neighborhood Redevelopment Plan, a junked simulator formerly used to study motion sickness at the United Hospital in Northern New Jersey became available—at no cost. Cardona grabbed it and launched “Project Kitty Hawk” with the goal to rebuild it to FAA Standards. Only the motion platform and floor mount could be salvaged.

But with help from major corporations and various sources, and with the key donation of a DMC-2143 multiaxis controller and AMP-20341 drive from Galil Motion Control, Cardona was able to “scrape together from surplus parts most of what we needed to get our flight simulator system up and running.”

“Prior to having the Galil controller, people did not take us seriously because the original controller that came with the simulator was obsolete. Nor did it have the resolution or response required. Once we had the Galil controller, then the whole atmosphere changed for the better and we got a lot of support,” said Cardona.

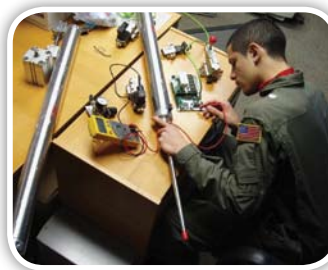
The Galil controller is used to control the pitch, roll and yaw motion of the simulator platform using three of its four axes. The fourth axis is used to keep the simulator in sync with the moving visuals shown on the computer screens and designed to mimic precisely what pilots see through the windows of the aircraft they are flying. One of the challenges was controlling the pneumatic valves of the simulator because of their inherent lag. To solve this, Galil’s PID tuning filter was used to perfectly compensate the valves.

In addition, the dual loop feature of the DMC-2143 controller allowed an encoder to be placed on both the load and the control valves, enabling Cardona to compensate for any system lag by offsetting the visual.

It turned out that the Galil controller could also be used to purposely offset the visual to simulate cases where the pilot might experience a delay in visual with respect to the actual motion. This is what typically causes motion sickness, something that all student pilots are likely to experience and need to overcome.

Another useful feature of the Galil controller is its ability to handle high resolution sensors. “This allows us to fine tune the system such that it runs in concert with the computer generated flight model which is recalculated hundreds of times per second. The ability of the Galil controller to process high resolution inputs allows the simulator to trick the brain into thinking it is really in motion even though the simulator base is stationary. That is very important because young students need to feel the motion, they need to believe they’re in an aircraft,” said Cardona.

Cardona reports that Project Kitty Hawk is still a work in progress, but thanks to the Galil controller and its ability to replicate the dynamics of flight with over 95% accuracy, the simulator is on its way toward FAA certification. ■



Galil’s DMC-2143 4-axis motion controller and drive is used by the Project Kitty Hawk team to control the pitch, roll and yaw of their flight simulator.

Galil. We Move the World.

With over 500,000 controllers installed worldwide, Galil is the leading supplier of motion controllers. Galil's legacy of innovation began in 1983 with the introduction of the first microprocessor-based servo motion controller. Today, Galil continues its leadership by offering the most powerful, cost-effective and easy-to-use controllers to accommodate all your motion and I/O needs.

Galil offers a broad array of motion controllers in a variety of formats: single and multi-axis, card-level and box-level, bus-based and stand-alone. Galil's Ethernet/RS232 and PCI controllers are available in an Econo version for lowest cost and Accelera version for ultra high-speed performance. Plug-in, multi-axis drives for steppers and servos save space, cost and wiring. For intelligent I/O control, the RIO Pocket PLC is compact, low-cost and packed with analog and digital I/O.

At Galil, we share our expertise with our customers. You will find a wealth of information on our website at <http://www.galilmc.com>. Here you can view any of Galil's free web-tutorials, read an application note or white paper, post a question on our bulletin board, or download the latest software and manuals.

Exceptional application support is a top priority at Galil. Call Galil today at 800-377-6329 to discuss your project with one of our highly-trained applications engineers. ■



ACCELERA CONTROLLERS AND DRIVES	
DMC-40x0	Ethernet/RS232
DMC-18x6	PCI

ECONO CONTROLLERS AND DRIVES	
DMC-41x3	Ethernet/RS232 — New!
DMC-21x3	Ethernet/RS232
DMC-18x2	PCI

SINGLE-AXIS CONTROLLERS AND DRIVES	
DMC-1415	Ethernet/RS232
CDS-3310	Ethernet/RS232

POCKET PLC I/O CONTROLLER	
RIO-47xxx	Ethernet/RS232

SOFTWARE TOOLS	
GalilTools.	Servo Tuning and analysis software
Ladder Interface.	Converts Ladder program into DMC code for RIO Pocket PLC.
Galil PVT.	Software tool for PVT mode of motion.



From top:
DMC-40x0 Accelera Controller
DMC-21x3 Econo Controller
DMC-18x6 PCI Controller
RIO Pocket PLC

FREE	Online Support Tools
✓	Application notes, white papers and industry articles http://www.galilmc.com/support/application-notes.php
✓	Free 2-minute how-to videos http://www.galilmc.com/learning/two-minute-videos.php
✓	Over 20 tutorials about servo tuning, motion programming, & motors and drives http://www.galilmc.com/learning/tutorials.php
✓	MotionCode™ Toolkit, step-by-step solutions with downloadable code http://www.galilmc.com/learning/motioncode.php
✓	MotorSizer™ Tool for quick sizing of stepper and servo motion systems http://www.galilmc.com/learning/motorsizer.php
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