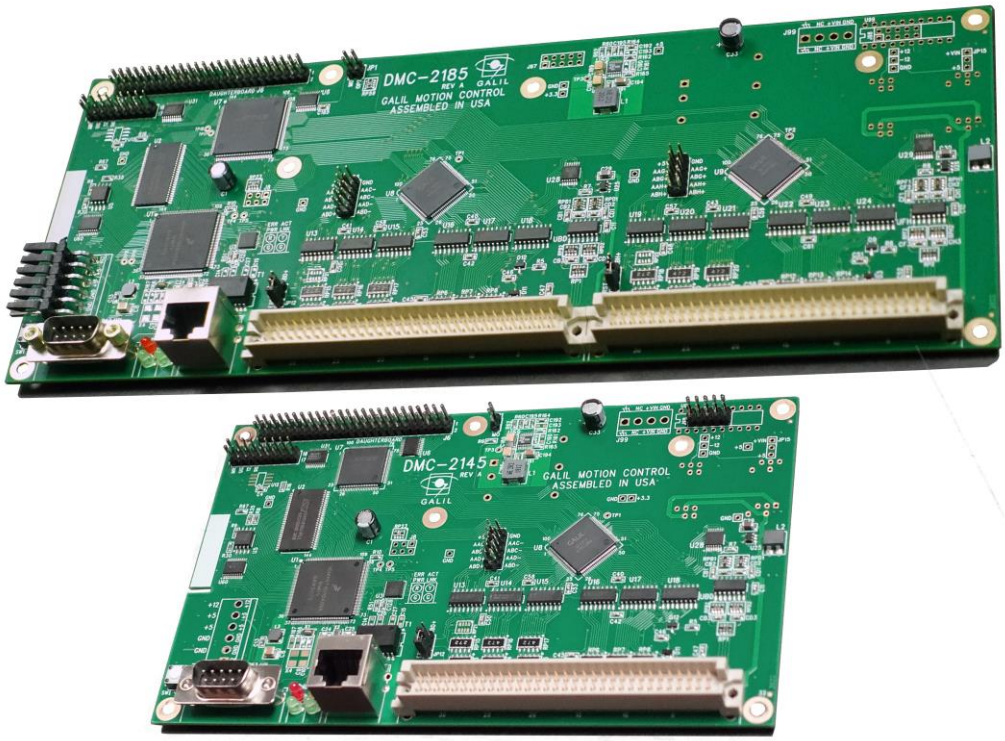
Galil Motion Control



DMC –21x5

Datasheet

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sales@electromate.com

Product Description

The DMC-21x5 motion controller series based on the ARM processor is a major performance upgrade for the venerable DMC-21x3 series. Like its predecessor it is available in 1 to 8 axes. It maintains the same physical specifications as the previous version including size and connector placement. Therefore the DMC-21x5 can use all of the stepper and servo motor driver and I/O expansion boards that are available for the DMC-21x3. Some of the enhancements to the DMC-21x5 include 100 Base-T Ethernet, encoder speeds of up to 15 million counts/sec, increased user-created application program space, and faster servo update rates.

The DMC-21x5 is available in the same card, din mount, and box versions as the DMC-21x3. The DMC-21x5 can operate either as a stand-alone controller or be controlled by a PC via 10/100Base-T Ethernet or RS-232. These units can be powered by +5V and +/-12V or by a single 12V, 24V or 48V power supply.

Each axis is individually configurable for stepper or servo motor operation. Standard features include PID compensation with velocity and acceleration feedforward, numerous modes of motion to accomplish almost any motion requirement, multitasking for simultaneously running up to eight programs, and I/O processing for synchronizing motion with external events.

Features

- Ethernet 10/100Base-T port or RS-232.
- Optional plug-in amplifier boards for driving stepper, brush, or brushless servo motors up to 500 Watts. Or, connect to external drives of any power range.
- User configurable for stepper or servo motors on any combination of axes.
- Accepts up to 15MHz encoder frequencies for servos and outputs up to 3MHz for steppers.
- PID compensation with velocity and acceleration feedforward, integration limits, notch filter and low-pass filter.
- Modes of motion include jogging, point-to-point positioning, contouring, linear and circular interpolation, electronic gearing and ECAM. Ellipse scaling, slow-down around corners, infinite segment feed and feedrate override.
- Over 200 English-like commands including conditional statements and event triggers.
- Non-volatile memory for programs, variables and arrays.
- Multitasking for concurrent execution of up to eight programs.
- Home input and forward and reverse end-of-travel limits for every axis.
- Uncommitted, TTL (5V) inputs and TTL (5V) outputs:
  - 1- 4-axis models: 8 inputs and 8 outputs
  - 5- 8-axis models: 16 inputs and 16 outputs
- High speed position latch for each axis and output compare.
- Dual encoder inputs for each servo axis.
- 4 kHz servo update on up to 8 axes.
- Communication drivers for Windows, and Linux.
- Electrically and Mechanically (plug-in) compatible with the DMC-21x3.

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Motion Controller	
Processor	ARM core based clock multiplying processor with DSP functions
Communication	10/100BASE-T Ethernet with Auto MDIX, one RS232 port
Program memory size	4000 lines x 80 characters
# of Variables	510
# of Arrays	24000 array elements in 30 arrays
Position Range	32-bit, automatic rollover
Maximum Velocity	15 million counts/s
Maximum Acceleration	1 billion counts/s^2

Power and Mechanical	
Power requirements	20-60 V_{DC} , or (+5V_{DC} & ±12V_{DC})
Operational temperature	0 – 70º C
Humidity	20 – 95 % RH, non-condensing
Dimensions	**1-4 axes card :** 4.25" x 7.0" **4 axes Box :** 5.6" x 8.6" x 1.9" **5-8 axes card :** 4.25" x 10.75"

Configurable Filter Features
Proportional gain
Torque limit
Integral gain
Offset
Profile filtering
Derivative gain
Feed-forward acceleration
Low-pass filter (Pole)
Notch
Dual-loop feedback mode
Feed-forward velocity

RoHS Compliant

Modes of Motion	
Position Relative & Position Absolute	Absolute and relative positioning following a trapezoidal velocity profile. Phase correction and profile smoothing available.
Jogging	Velocity control where no final endpoint is prescribed.
Vector Mode	2D motion path consisting of linear and arc segments. Motion along the path is continuous at the prescribed vector speed even at transitions between linear and circular segments.
Linear Interpolation	1-8 axes of coordinated linear profiling.
Gearing & Gantry Mode	Electronic gearing and gantry mode with ramped gearing.
Electronic camming (ECAM)	Following an arbitrary trajectory based upon a master encoder position.
Contour	Allows any arbitrary profile and any set of axes to be prescribed.

General Purpose I/O				
	Number of I/O		Voltage	Details
	1-4 axis	5-8 axis		
Uncommitted TTL inputs[1]	8	16	5	Can be configured for use as high-speed latch (position capture)
Uncommitted TTL outputs	8	16	5	Sink or Source up to 24 mA at 5V
Digital I/O (DB-28040)	40	40	3.3V , 5V (optional)	Additional 40 digital I/O configurable in banks of 8 I/O points
Analog Inputs (DB-28040)	8	8	±10, ±5, 0-5, 0-10 V	12-bit, 16-bit optional, can be used as position feedback

Feature Specific I/O				
	Number of I/O		Description	Details
	1-4 axis	5-8 axis		
Reverse/Forward Limit Switches	per Axis		5 V_{DC} TTL	Internally pulled up to +5V, switch to Ground
Home Input	per Axis		5 V_{DC} TTL	Internally pulled up to +5V, switch to Ground
Amplifier Enable Output	per Axis		5 V_{DC} TTL	Can be configured for High / Low Enable via ICM
Stepper (Step/Dir signals)	per Axis		5 V_{DC} Step/Dir TTL Signal	3 MHz max output
Servo control (Motor command line)	per Axis		±10V analog output	16-bit resolution
Quadrature Encoder Inputs	2 per Axis[1]		+/-12V_{DC} or TTL	15 MHz input max
Hall inputs	per Axis		3x 0-5 V_{DC} TTL inputs	When equipped with the AMP-205x0 Module
Abort	1		5 V_{DC} TTL	Internally pulled up to +5V, switch to Ground
Reset	1		5 V_{DC} TTL	Internally pulled up to +5V, switch to Ground
Output Compare	1	2	5 V_{DC} TTL	Also known as Pulse on Position
Error out	1		5 V_{DC} TTL	Internally pulled up to +5V, switch to Ground

[1] Each unused auxiliary encoder can be used as 2 additional digital inputs.

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Ordering Options

The DMC-21x5 controller board comes in two sizes, 1-4 axis models (labeled A-D) and 5-8 axis models (labeled E-H). The number of axis is designed by x in the part number DMC-21x5. In addition, Axis A-D and Axis E-H have their own set of axis-specific options that can be ordered. For example, Axis A-D can have a different set of feedback options as Axis E-H even though they reside on the same DMC-21x5 board. The DMC-21x5 can also be ordered with optional internal amplifiers, labeled as AMP or SDM. These amplifiers are mounted on the top of the DMC-21x5 board. The abstract internal layout of a DMC-21x5 with optional AMP/SDM is shown for 1-4 axis on in the figure below.

1-4 axis DMC-21x5 model (left); 5-8 axis DMC-21x5 model (right). An ICM is selected when internal amplifier is not required on a group of 4-axis.

The full DMC-21x5 part number is a combination of the DMC controller part number (DMC-21x5) and optional amplifier types (AMP-20*XYZ or SDM*-20*XYZ*), where *Y* is customization options for that specific board or set of axis. See the link provided below. X and Z are numbers defining specific part number for the amplifier or driver board.

Use the Part Number Generator for building your DMC-21x5
http://www.galil.com/order/part-number-generator/dmc-21x5

Example Part Numbers	
DMC-2145-DC48-DB-28040-ICM-20105(BOX)	4-axis Ethernet/RS-232 controller in a Metal Enclosure powered by 48VDC DB-28040: 40 extended I/O with 5V (TTL) logic and 8 Analog inputs with 12-bit ADC resolution ICM-20105 provides opto-isolation on 8 digital inputs, Limits, Home and Amp Enable 1-8 digital outputs: 500 mA, 12-24V opto-isolated, sourcing
DMC-2185-DC24-DB-28040(5V,16BIT)-SDM-20640-AMP-20440	8-axis Ethernet/RS-232 controller with 24VDC to power the controller Four axes 3.0 A stepper motor drives with micro-step resolution of 1/64 step on A-D axes Four 200W servo drives for brush motors on E-H axes DB-28040: 40 extended I/O with 5V (TTL) logic and 8 Analog inputs with 16-bit ADC resolution 1-8 digital outputs: 24 mA TTL buffer 9-16 digital outputs: 24 mA TTL buffer

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DMC-21x5 Options	
Part Number	**Description**
DIN	DIN Rail Mount
16bit	16-bit analog inputs
DC12 / DC24 / DC48	Power Controller with 12 V_{DC} , 24 V_{DC} or 48 V_{DC}
ISCNTL	Isolate power between the amplifier and the controller board similar to Remove J98 on the DMC-21x3
TRES	Encoder terminating resistors
MO	Motor off jumper installed by default

	AMP-205x0 (only on ABCD)	**AMP-20341**	**AMP-20440**
Motor Type	Brushed/ 3ϕ Brushless servo	Brushed Servo	Brushed servo
Amplifier Axes	4 or 2	4	4
Current Drive	PWM	Linear	PWM
Drive Mode	Chopper, Inverter	Linear	Inverter
Commutation	Trap w/120° halls[1]	Brushed only	Brushed only
Power per axis (Watts per channel)	500	20	200
Cont. Current (Amps)	7	1	3.3
Peak Current (Amps)	10	1	3.3
Bus Voltage (VDC)	20-60	+/- 12-30 bipolar	20-60[1]
Gains (A/V)	0.4, 0.7, 1.0	0.1	0.5, 1.0, 2.0
Switching Freq. (kHz)	60 or 140[2]	–	60
Max Current loop BW (kHz)[3]	8	10	8
Min. Inductance (mH)	0.5	.05	0.5
Over-Voltage	Yes	No	Yes
Under-Voltage	Yes	No	No
Over-Current	Yes	Fused	Yes
Over-Temperature	Yes	Thermal Shutdown	No
ELO / Abort	Yes	Yes	Yes
Adjustable Current Loop	Yes	No	Yes
8 Analog inputs 12-bit ADC (16-bit ADC optional)	Yes	No	No
Shunt Option	Yes	No	Yes
SSR Option	No	Yes	No

[1] Contact Galil for more options.
[2] Contact Galil regarding the 140kHz option for low inductance motors.
[3] Current loop bandwidth is system dependent. These values are what can be typically expected.

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SDM Modules

The following embedded stepper amplifier drives are in the same black box as the DMC. Like our servo options, they are available in banks of 2 or 4-axes; note the 2-axes options take up the same space as a bank of 4-axes.

	SDM-20242	**SDM-206x0 (only on ABCD)**
Motor Type	Stepper	Stepper
Amplifier Axis	Bank of 4 axis	Bank 2 or 4 axis
Microstepping	$1, \frac{1}{2}, \frac{1}{4}, \frac{1}{16}$	$\frac{1}{64}$
Power per axis	42 W	180 W
Peak Current	1.4 A/ϕ	3.0 A/ϕ
Bus Voltage	12-30 V_{DC}	12-60 V_{DC}
Gains	0.5, 0.75, 1.0, 1.4	0.5, 1.0, 2.0, 3.0
Switching Freq.	27 kHz (nominal)	60 kHz
Min. Inductance	0.5 mH	0.5 mH
Over-Voltage	No	No
Under-Voltage	No	Yes
Over-Current	Yes	Yes
Over-Temperature	No	No
ELO / Abort	Yes	Yes
Low Current Mode (LC)	Yes	Yes
8 Analog inputs 12-bit ADC (16-bit ADC optional)	No	Yes

AMP/SDM Options

The following options can apply to both our servo and stepper (AMP/SDM) modules.

Part Number	**Description**
SSR	Solid state relay on the AMP-20341 power outputs
ISCNTL	Isolates power between the controller and the amplifier(s)

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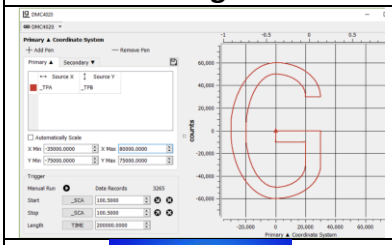
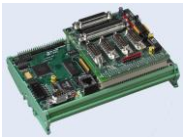
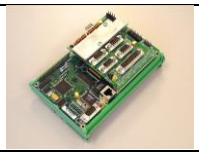
Accessories		
Image	**Part Number**	**Description**
	GDK SOFTWARE	Servo Tuning and Analysis with Terminal, Program Editor, Debugger and Setup tools
	ICM-20100	Provides D-Sub connections between the DMC-21x3 series controllers and other system elements, such as amplifiers, encoders, and external switches.
	ICM-20105	The ICM-20105 provides opto-isolated I/O. The four 15-pin D-sub provides axis signals. One 37-pin D-Sub for the 8 digital inputs, 8 high side drive 500 mA digital outputs, home switches and limit switches. One 25-pin D-Sub for 4 axes of auxiliary encoders.
	AMP-20341	AMP-20341 contains four linear drives for operating small brush-type servo motors. Requires a ± 12–30 DC Bipolar Supply. 20 W / axis or 60 W total.
	AMP-20440	The AMP-20440 offers (four axes) brush style amplifiers with a power capacity of 200 W / axis. The amplifier is operational from 18-60 VDC.
	AMP-20520 AMP-20540	The AMP-20540 (four-axis) and AMP-20520 (two-axis) are multi-axis brush/brushless amplifiers that are capable of handling 500 watts of continuous power per axis.
	PSR-12-24 PSR-6-48	12A-24 VDC Power supply 6A-48 VDC Power Supply
	SDM-20242	SDM-20242 is a stepper driver module capable of driving up to four bipolar two-phase stepper motors with current is selectable of 0.5, 0.75, 1.0, and 1.4 Amps/Phase.
	SDM-20640	The SDM-20640 (4-axis) offers micro-stepper drives for bipolar two-phase step motors with 1/64 micro-step resolution. Adjustable for 0.5, 1.0, 2.0, or 3.0 Amps/ axis.
	DB-28040	The DB-28040 provides 40 digital I/O 3.3V TTL logic (5V TTL optional) along with 8 analog inputs with 12bit ADC resolution. 16-bit ADC optional.

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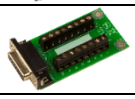
Image	Part Number	Description
	BLM-N23-50-1000-B	NEMA 23 Brushless Motor with 1000-line encoder
	CABLE-44M-1M	44-pin HD male D to discrete wires-1 meter
	CABLE-44M-2M	44-pin HD male D to discrete wires-2 meter
	CABLE-15-1M	15-pin HD male D to discrete wires-1 meter
	CABLE-15-2M	15-pin HD male D to discrete wires-2 meter
	CABLE-9-PIN-D	RS232 female to female straight through cable
	ICS-48044-M	44-pin D HD male to screw terminals
	ICS-48115-F	15-pin D LD female to screw term