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DMC - 40x0

Datasheet

Product Description

The DMC-40x0 is Galil's highest performance, stand-alone motor controller. It belongs to Galil's latest generation motion controller family which accepts encoder inputs up to 22 MHz, provides servo update rates as high as 16 kHz, and processes commands in as fast as 40 microseconds—10 times faster than prior generation controllers.

The DMC-40x0 is a full-featured motion controller packaged with optional multi-axis drives in a compact, metal enclosure. The unit operates stand-alone or interfaces to a PC with Ethernet 10/100Base-T or RS232. The controller includes optically isolated I/O, high-power outputs capable of driving brakes or relays, and analog inputs for interfacing to analog sensors. The DMC-40x0 controller and drive unit accepts power from a single 20–80 VDC source.

The DMC-40x0 is available in one through eight axis formats, and each axis is user-configurable for stepper or servo motor operation. Standard programming features include PID compensation with velocity and acceleration feedforward, multitasking for simultaneously running up to eight programs, and I/O processing for synchronizing motion with external events. Modes of motion include point-to-point positioning, position tracking, jogging, linear and circular interpolation, PVT, contouring, electronic gearing and electronic cam (ECAM). Like all Galil controllers, the DMC-40x0 controllers use Galil's popular, intuitive command language, making them very easy to program. GalilTools servo design software further simplifies system set-up with "one-button" servo tuning and real-time display of position and velocity information.

Features

- Packaged controller in 1 through 8 axis versions: DMC-40x0 where x=1,2,3,4,5,6,7,8 axes
- (2) 10/100 Base-T Ethernet port with Auto MDIX; (2) RS232 ports up to 115 kbaud
- User-configurable for stepper or servo motors on any combination of axes.
- Available with internal, multiaxis servo or stepper drives. Or, connect to external drives.
- Accepts up to 22 MHz encoder frequencies for servos; Outputs up to 6 MHz for steppers
- Sample times as low as 31 microseconds per axis; fast command processing
- Advanced PID compensation with velocity and acceleration feedforward, integration limits, notch filter and low-pass filter
- Modes of motion include jogging, point-to-point positioning, position tracking, contouring, linear and circular interpolation, electronic gearing and electronic cam.
- Ellipse scaling, slow-down around corners, infinite segment feed and feedrate override
- Multitasking for concurrent execution of up to eight application programs. Ultra-fast command processing
- Expanding, non-volatile memory for application programs, variables and arrays
- Optically isolated home input, forward and reverse limits for every axis
- Uncommitted, isolated I/O:
  - 1-4-axis: 8 inputs and 8 outputs
  - 5-8-axis: 16 inputs and 16 outputs
  - Isolated, high-power outputs for driving brakes or relays
  - 8 uncommitted analog inputs
  - High speed position latch and output compare
  - 32 additional 3.3 TTL V I/O (5 V optional); Add more I/O with RIO-471xx PLC
- 2 line x 8 character programmable LCD
- Accepts single 20–80 VDC input
- Communication drivers for Windows and Linux
- Custom hardware and firmware options available

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Motion Controller	
Processor	RISC-based clock multiplying processor with DSP functions, Galil's 5th generation ASIC
Communication	10/100 Base-T Ethernet with Auto MDIX Main and Aux RS232 serial ports More options available see below.
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	22 million counts/s
Maximum Acceleration	1 billion counts/s^2

Power and Mechanical	
Power requirements	20-80 V_{DC}, 12-16 W @ 25 deg C
Operational temperature	0 – 70 deg C
Humidity	20 – 95 % RH, non-condensing
Dimensions	**1-4 axes models**: 8.05 x 7.25" x 1.41" **5-8 axes models**: 11.5" x 7.25" x 1.41"

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

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.
PVT	Motion path described in incremental position, velocity, and change of time.

Minimum Servo Update Rate	
# of axes	Standard Firmware
1-2	62 usec, 16 kHz
3-4	125 usec, 8 kHz
5-6	156 usec, 6.4 kHz
7-8	187 usec, 5.4 kHz

General Purpose I/O				
	Number of I/O		Voltage	Details
	1-4 axis	5-8 axis		
Opto-isolated inputs[1]	8	16	5-24 V_{DC}	Can be configured for use as high-speed latch (position capture).
Opto-isolated outputs	8	16	12-24 V_{DC}	500mA Sourcing, can be configured as brake output.
Analog Inputs	8	8	±10, ±5, 0-5, 0-10 V	12-bit, 16-bit optional, can be used as position feedback
Extended I/O[1]	32	32	3.3 V_{DC}, 5V_{DC} optional	Input or Output configurable in banks of 8

Feature Specific I/O				
	Number of I/O		Description	Details
	1-4 axis	5-8 axis		
Reverse/Forward Limit Switches	per Axis		5-24 V_{DC} opto-isolated	
Home Input	per Axis		5-24 V_{DC}, opto-isolated	
Amplifier Enable Output	per Axis		+5, +12V_{DC} controller powered or 5-24V_{DC} opto-isolated	See ICM Modules for all AMP enable options.
Stepper (Step/Dir signals)	per Axis		0-5 V_{DC} Step/Dir TTL Signal	6 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	22 MHz input max See ICM Modules for all feedback options
Hall inputs	per Axis		3x 0-5V TTL inputs	When equipped with some AMP Modules
Abort	1		5-24V_{DC} opto-isolated	
Reset	1		5-24V_{DC} opto-isolated	
Electronic lock-out	1		5-24V_{DC} opto-isolated	When equipped with AMP Modules
Output compare	1	2	0-5V TTL	Also known as pulse on position
Error out	1		0-5V TTL	

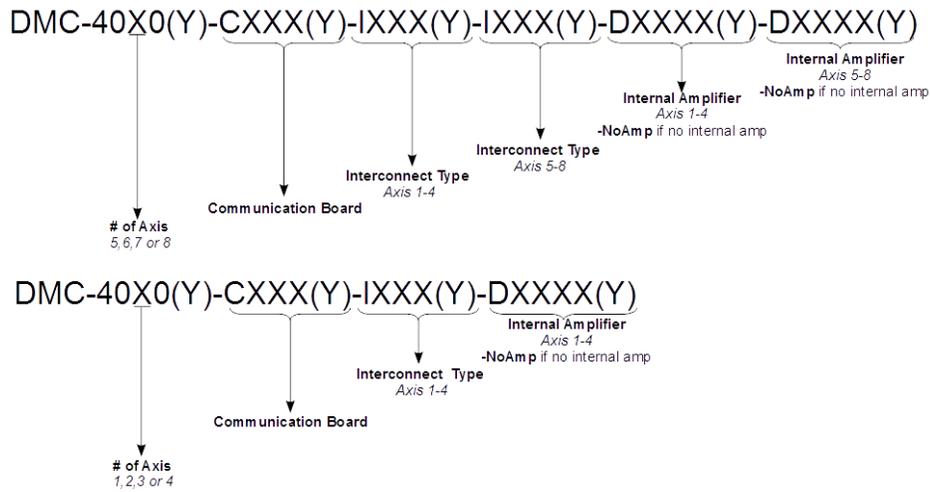[1] Each unused auxiliary encoder can be used as 2 additional digital inputs.

Ordering Options

Internal to a DMC-40x0 unit are several modular boards that change the connector layout, pin-out, and functionality of the unit. In order to provide a full DMC-40x0 part number for 1-4 axis units, the user must specify a communication board (CMB), interconnect module (ICM), and controller board (DMC). 5-8 axis models require the specification of an additional ICM module. Both 1-4 and 5-8 axis models have options for internal servo (AMP) and stepper (SDM) modules. In addition to the flexibility of choosing various modules, each module features additional options.

1-4 axis DMC-40x0 model (left); 5-8 axis DMC-40x0 model (right)

The following diagram shows the layout of a complete DMC-40x0 part number for both 1-4 axes and 5-8 axes models. X designates the part numbers that will distinguish the different module options and Y designates the various options that modify the module. Often, several Y-options can be stacked on a single module and are separated by commas.

Use the Part Number Generator for building your DMC-40x0
http://www.galil.com/order/part-number-generator/dmc-40x0

Example Part Numbers	

DMC-4040-C012-I000(SSI,24V,HAEN,Sink)-D3540	4-Axis Stand-Alone Controller
	C012, default: 100-BaseT Ethernet, 32 Extended I/O, LCD, RS-232
	I000, default: ICM with 15-pin D-sub connectors
	        5-24V opto-isolated, high amplifier enable, sinking
	        SSI feedback option
	D3540: Four 600W Sinusoidal Servo Drives for Brush / Brushless motors

DMC-4060(12V)-C022-I200-I200	6-Axis Stand-Alone Controller
	        12V controller power option
	C1022: Dual 100-BaseT Ethernet, 32 Extended I/O, LCD, RS-232
	I200: ICM with 26 pin High Density D-type connectors
	I200: ICM with 26 pin High Density D-type connectors
	Notes
	  • No internal amplifiers are selected.
	  • The default amplifier enable is 5V internally powered, high amplifier enable sinking. Amplifier enables circuits that can be specified by a Y-option in the ICM.

DMC-40x0

DMC-40x0(Y) – CXXX(Y) – IXXX(Y) – DXXXX(Y)

By default, the DMC-40x0 is paired with the CMB-41012 (-C012) and ICM-42000 (-I000) thus the DMC-40x0-C012-I000 and DMC-40x0-C012-I000-I000 are the default part numbers for 1-4 axes and 5-8 axes, respectively, and where x specifies the number of axes.

*Default 1-4 axes model (left), default 5-8 axes model (right)*

DMC-40x0 Options

Part Number	Description
DIN	DIN Rail Mount
12V	Power Controller with 12 V_{DC}
16bit	16-bit analog inputs
4-20mA	4-20mA analog inputs
ISCNTL	Isolate Controller Power
TRES	Encoder terminating resistors
ETL	ETL certification
MO	Motor off jumper installed by default

CMB Modules

DMC – 40x0(Y) - CXXX(Y) – IXXX(Y) – DXXXX(Y)

The CMB (communication board) provides the DMC-40x0 with a communication interface to external devices, an LCD screen for displaying default status codes or customized messages, and 32 configurable TTL I/O. The default CMB-41012 (-C012) provides both Ethernet and an RS232 as main communication ports and an auxiliary RS232 port for communication with HMI's and other devices. The CMB-41022 (-C022) adds an additional Ethernet port for daisy chaining.
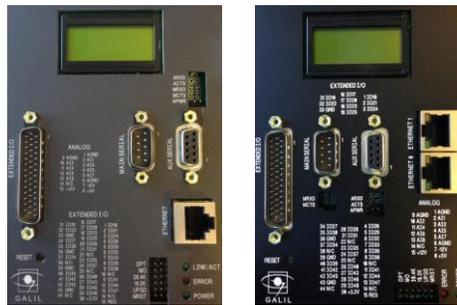
*Default CMB-41012 (-C012) (left). CMB-41022 (-C022) (right).*

Modules	Description
CMB-41012 (-C012, **default**)	Default communication board
CMB-41022 (-C022)	Dual Ethernet communication board

Options

Part Number	Description
5V	Upgrades extended TTL I/O to 5V
P1422	RS-422 on main serial port
P2422	RS-422 on auxiliary serial port
P422	RS-422 on both main and auxiliary serial port

ICM Modules

DMC – 40x0(Y) – CXXX(Y) – **IXXX(Y)** – DXXXX(Y)

ICM (interconnect modules) provide the pin-out interface from the I/O of the DMC controller to external devices. These pin-outs include signals for driving external amplifiers, limit switches, homing, opto-isolated inputs/outputs, and more.
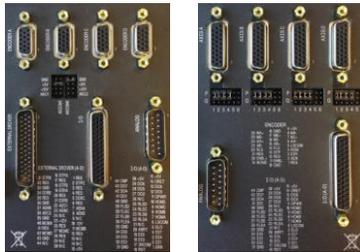
ICM-42000 (-I000) and ICM-42100 (-I100) (left). ICM-42200 (-I200) (right).

Modules	Description
ICM-42000 (-I000, **default**)	Default interconnect board
ICM-42100 (-I100)	Same mechanical layout and pin-out as ICM-42000 (-I000). Allows additional internal hardware for Sin/Cos feedback signals. Encoder inputs are terminated with 120Ω.
ICM-42200 (-I200)	26-pin encoder connector that includes external amplifier I/O. Recommended for use when interfacing with external amplifiers.

Options

Part Number	Description
SSI	SSI Feedback
BiSS	BiSS Feedback
DIFF	Differential ±10 motor command outputs
STEP	Differential STEP/DIR outputs

Amplifier Enable
The amplifier enable part number requires one option to be specified from the following three categories:

Voltage		Logic		Sinking/Sourcing	
Part Number	Description	Part Number	Description	Part Number	Description
5V	+5V internal power	HAEN	High amplifier enable	Sink	Sinking
12V	+12V internal power	LAEN	Low Amplifier enable	Source	Sourcing
24V	5-24V optoisoalted				

AMP Modules

DMC – 40x0(Y) – CXXX(Y) – IXXX(Y) – **DXXXX(Y)**

	AMP-430x0 (-D30x0)	AMP-43140 (-D3140)	AMP-43240 (-D3240)	AMP-435x0 (-D35x0)	AMP-43640 (-D3640)	AMP-43740(D3740)
Motor type	Brushed/ 3φ Brushless servo	Brushed Servo	Brushed/ 3φ Brushless servo	Brushed/ 3φ Brushless servo	3φ Brushless servo	Brushed/ 3φ Brushless servo
Amplifier Axes	4 or 2	4	4	4 or 2	4	4
Current Drive	PWM	Linear	PWM	PWM	Linear	PWM
Drive Mode	Chopper, Inverter	Linear	Chopper	Phase Shift	Linear	Phase Shift
Commutation	Trap w/120° halls	Brushed only	Trap w/120° halls	Sinusoidal	Sinusoidal	Sinusoidal
Power per axis (Watts per channel)	500	20	750	600	20	1200
Cont. Current (Amps)	7	1	10	8	1	16
Peak Current (Amps)	10	1	20	15	2	30
Bus Voltage (VDC)	20 or 80[1]	+/- 12-30 bipolar	20-80[1]	20-80[1]	15-40	20-80
Gains (A/V)	0.4, 0.7, 1.0	0.01[2], 0.1	0.5, 1.0, 2.0	0.4, 0.8, 1.6	0.2	0.8, 1.6, 3.2
Switching Freq. (kHz)	60 or 140[3]	–	24	33	–	20
Max Current loop BW (kHz)[4]	8	10	3	4	8	2.5
Min. Inductance (mH)	0.2 - 0.5	.05	0.8	0.5	.05	1
Over-Voltage	Yes	No	Yes	Yes	No	Yes
Under-Voltage	Yes	No	Yes	Yes	No	Yes
Over-Current	Yes	Fused	Yes	Yes	Fused	Yes
Short Circuit	Yes	Fused	Yes	Yes	Fused	Yes
Over-Temperature	Yes	Thermal Shutdown	Yes	Yes	Thermal Shutdown	Yes
ELO	Yes	Yes	Yes	Yes	Yes	Yes
Adjustable Current Loop	Yes	No	Yes	Yes	No	Yes
Shunt Option	Yes	No	Yes	Yes	Yes	Yes
SSR Option	No	Yes	No	No	No	No

[1] Contact Galil regarding the 160 V$_{DC}$ option.
[2] Available by ordering the 100mA option.
[3] Contact Galil regarding the 140kHz option.
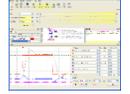[4] Current loop bandwidth is system dependent. These values are what can be typically expected.
[5] 0.75 mH @ 24 V$_{DC}$ bus voltage and 1.2 mH minimum @ 48 V$_{DC}$ bus voltage
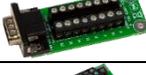[6] 0.2 mH when using chopper mode, 0.5 when using inverter mode

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-440x0 (-D40x0)	SDM-44140 (-D4140)
Motor type	Stepper	Stepper
Amplifier Axis	Bank of 2 or 4 axis	Bank of 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}	20-60 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
Short Circuit	Yes	Yes
Over-Temperature	No	No
ELO	Yes	Yes
Low Current Mode (LC)	Yes	Yes

AMP/SDM Options

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

Part Number	Description
HALLF[1]	Filtered hall sensors
SSR[1]	Solid state relay
ISAMP	Isolates power between amplifiers (two banks of AMP/SDMs required)

1 Not available for all amplifier options

Accessories

Image	Part Number	Description
	GALILSUITE SOFTWARE	Servo Tuning and Analysis with Program Editor and Terminal
	GALILTOOLS SOFTWARE	GalilTools programming software for Galil controllers
	EPICS SOFTWARE	Communication Drivers and Device Support to create a Galil EPICS IOC
	FREQUENCY ANALYSIS SOFTWARE	Servo Tuning in Frequency Domain
	GALILPVT	Galil PVT Software for PVT mode of Motion
	PSR-12-24	12A-24 VDC Power supply
	PSR-6-48	6A-48 VDC Power Supply
	BLM-N23-50-1000-B	Nema 23 Brushless Motor with 1000-line encoder

Accessories

Image	Part Number	Description
	CABLE-15-1M	15-pin HD male D to discrete wires-1 meter
	CABLE-15-2M	15-pin HD male D-sub to discrete wires, 2 meter
	CABLE-26-1M	26-pin HD male D-sub to discrete wires, 1 meter
	CABLE-44F-1M	44-pin HD female D to discrete wires-1 meter
	CABLE-44M-1M	44-pin HD male D to discrete wires-1 meter
	CABLE-9-PIN-D	RS232 female to female straight through cable
	ICS-48015-M	15-pin D HD male to screw term
	ICS-48026-M	26-pin D HD male to screw terminals
	ICS-48032-F	44-pin D HD female to screw term with opto-isolation
	ICS-48044-F	44-pin D HD female to screw term
	ICS-48044-M	44-pin D HD male to screw terminals
	ICS-48115-F	15-pin D LD female to screw term