

# Pocket Motion Controller & Drive—1-axis

## DMC-30000 Series

### Product Description

The DMC-30000 Pocket Motion Controller Series is Galil's latest generation single-axis motion controller. It uses a 32-bit RISC processor to provide higher speed than older models. The DMC-30000 is available as a compact card-level or box-level unit and connects to a stepper or servo motor amplifier of any power range. Or, the DMC-30000 can be purchased with an internal 800-Watt brushless sine drive or stepper drive which minimizes space, cost and wiring. The motion controller operates stand-alone or can be networked to a PC via Ethernet.

*DMC-30012  
Single-axis  
Controller and  
800 W Brushless  
Sine Drive*



Features include PID compensation with velocity and acceleration feedforward, program memory with multitasking for concurrent execution of four programs, and uncommitted optically isolated inputs and outputs for synchronizing motion with external events. Modes of motion include point-to-point positioning, jogging, contouring, PVT, electronic gearing and electronic cam.

Like all Galil motion controllers, these controllers use a simple, English-like command language which makes them very easy to program. GalilTools software further simplifies system set-up with "one button" servo tuning and real-time display of position and velocity information.

### Features

- *Single-axis motion controller with optional servo or stepper motor drive in compact enclosure:  
DMC-30012— Brushed/brushless sine drive;  
10 A rms cont., 15 A peak, 20–80 VDC  
DMC-30016— Stepper drive; 1.4 A/phase, 12–30 VDC  
DMC-30017— Microstep drive; 6 A/phase, 20–80 VDC*
- *Motion controller also available as card-level or box-level unit which can connect to external stepper or servo amplifier of any power range*
- *Two daisy-chainable Ethernet 100 Base-T ports.  
One 115kbaud RS232 port*
- *Ethernet supports multiple masters and slaves. TCP/IP, UDP and Modbus TCP master protocol for communication with I/O devices*
- *Encoder feedback up to 15 MHz. Quadrature standard; SSI, BiSS, and sinusoidal encoder options. Main and auxiliary encoder inputs*
- *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, PVT, electronic gearing and electronic cam*
- *Over 200 English-like commands executable by controller. Includes conditional statements and event triggers*
- *Non-volatile memory for programs, variables and arrays. Concurrent execution of four programs.*
- *Optically isolated forward and reverse limit inputs and homing input*
- *8 uncommitted, isolated inputs and 4 isolated outputs*
- *High speed position latch and output compare*
- *2 uncommitted analog inputs and 1 analog output*
- *Controller available with optional dc-to-dc converter for 20–80 VDC input*
- *DMC-30010/DMC-30011-CARD: 3.0" × 4.0"  
DMC-30010/DMC-30011-BOX: 3.9" × 4.2" × 1.4"  
DMC-30012/30016/30017-BOX: 3.9" × 5.0" × 1.5"*
- *Custom hardware and firmware available*

SINGLE AXIS

Sold & Serviced By:

**ELECTROMATE**

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# Pocket Motion Controller & Drive—1 axis

## DMC-30000 Series

### Specifications

#### System Processor

- RISC-Based processor with DSP functions

#### Communications Interface

- Two Ethernet 10/100BASE-T ports. (1) RS232 port up to 115 kbaud. Commands are sent in ASCII. A binary communication mode is also available as a standard feature. Daisy-chain Ethernet—no external hub required

#### Modes of Motion:

- Point-to-point positioning
- Position Tracking
- Jogging
- Electronic Gearing
- Electronic Cam
- Contouring
- Teach and playback
- PVT

#### Memory

- Program memory size—1000 lines × 40 characters
- 254 variables
- 3000 array elements in up to 6 arrays

#### Filter

- PID (proportional-integral-derivative) with velocity and acceleration feedforward
- Notch and low-pass filter
- Velocity smoothing to minimize jerk
- Integration limit
- Torque limit
- Offset adjustments

#### Kinematic Ranges

- Position: 32 bit ( $\pm 2.15$  billion counts per move; automatic rollover; no limit in jog or vector modes)
- Velocity: Up to 15 million counts/sec for servo motors
- Acceleration: Up to 67 million counts/sec<sup>2</sup>

#### Uncommitted I/O

- 8 isolated inputs
- 4 isolated outputs
- 2 analog inputs; 0–5 Volts, 12-bit ADC (16-bit option configurable  $\pm 10$  V)
- 1 uncommitted analog output  $\pm 10$  V, 16-bit DAC

#### High Speed Position Latch

- Latches encoder position

#### Dedicated Inputs

- Main encoder inputs—Channel A, A-, B, B-, I, I- ( $\pm 12$  V or TTL)
- Auxiliary encoder inputs
- Forward and reverse limit inputs—isolated
- Home input—isolated
- High-speed position latch input—isolated

#### Dedicated Outputs

- Analog motor command output with 16-bit DAC resolution
- Error output
- Amp enable
- High-speed position compare output

#### Minimum Servo Loop Update Time

- 125 microseconds

#### Maximum Encoder Feedback Rate

- 15 MHz

#### Maximum Stepper Rate

- 3 MHz

#### Power

- DMC-30010: 5 V,  $\pm 12$  V
- DMC-30011: 9–48 VDC
- DMC-30012/30017: 20–80 VDC
- DMC-30016: 12–30 VDC

#### Drive Specifications

- DMC-30012: 20–80 VDC; 10 A rms continuous, 15 A peak, servo
- DMC-30016: 12–30 VDC; 1.4 A/phase, stepper
- DMC-30017: 20–80 VDC; 6 A/phase, stepper

#### Environmental

- Operating temperature: 0–70° C
- Humidity: 20–95% RH, non-condensing

#### Mechanical

- DMC-30010/30011-CARD: 3.0" × 4.0"
- DMC-30010/30011-BOX: 3.9" × 4.2" × 1.4"
- DMC-30012/30016/30017-BOX: 3.9" × 5.0" × 1.5"

#### Connectors

- 44-pin HD Female D-sub—I/O
- 15-pin HD Female D-sub—encoder

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## DMC-30000 Series

### Instruction Set

#### Ethernet

DH	DHCP Configuration
HS	Handle switch
IA	Set IP address
IH	Open IP handle
IK	Ethernet port blocking
MB	Modbus
MU	Multicast address
MW	Modbus wait
SA	Send command
SM	Subnet mask

#### Servo Motor

AF	Analog feedback
AG	Set amplifier gain
AU	Set current loop gain
DV	Dual loop operation
FA	Acceleration feedforward
FV	Velocity feedforward
IL	Integrator limit
KD	Derivative constant
KI	Integrator constant
KP	Proportional constant
NB	Notch bandwidth
NF	Notch frequency
NZ	Notch zero
OF	Offset
PL	Pole
SH	Servo here
TK	Peak torque
TL	Torque limit
TM	Sample time

#### Stepper Motor

KS	Stepper motor smoothing
LC	Low current
QS	Error magnitude
YA	Step drive resolution
YB	Step motor resolution
YC	Encoder resolution
YR	Error correction
YS	Stepper position maintenance

#### Sine Commutation

BA	Brushless axis
BB	Brushless phase
BC	Brushless calibration
BD	Brushless degrees
BI	Brushless inputs
BM	Brushless modulo
BO	Brushless offset
BQ	Brushless offset dual DAC
BX	Sine Amp Initialization
BZ	Brushless zero

#### I/O

AL	Arm latch
AO	Analog output
AQ	Analog configuration
CB	Clear bit
II	Input interrupt
OB	Define output bit
OC	Output compare function

#### I/O (cont.)

OP	Output port
SB	Set bit
@AN[x]	Value of analog input x
@AO[x]	Analog output query
@IN[x]	State of digital input x
@OUT[x]	State of digital output x

#### System Configuration

BN	Burn parameters
BR	Brush motor enable
BV	Burn variables and arrays
BW	Brake Wait
CE	Configure encoder type
CF	Configure unsolicited messages handle
CI	Configure communication interrupt
CN	Configure switches
CW	Data adjustment bit
DE	Define dual encoder position
DF	Dual feedback
DP	Define position
DR	Data record update rate
EI	Event interrupts
EO	Echo
^L^K	Program protect (Lock)
LZ	Leading zeros format
MO	Motor off
MT	Motor type
PF	Position format
PW	Password
QD	Download array
RO	Realtime offset
RS	Reset
^R^S	Master reset
SI	Configure SSI
SS	Configure BiSS
SY	BiSS active level
UI	User interrupt
VF	Variable format

#### Math Functions

@ABS[x]	Absolute value of x
@ACOS[x]	Arc cosine of x
@ASIN[x]	Arc sine of x
@ATAN[x]	Arc tangent of x
@COM[x]	1's complement of x
@COS[x]	Cosine of x
@FRAC[x]	Fraction portion of x
@INT[x]	Integer portion of x
@RND[x]	Round of x
@SIN[x]	Sine of x
@SQR[x]	Square root of x
@TAN[x]	Tangent
-, /, +, *	Arithmetic commands
&, :, <>, =	Logical operations
\$	Hexadecimal

#### Interrogation

ID	Device identification
LA	List arrays
LL	List labels
LS	List program

#### Interrogation (cont.)

LV	List variables
MG	Message command
QH	Query hall state
QR	Data record
QU	Upload array
QZ	Return data record information
RL	Report latch
RP	Report command position
RT	Real time
^R^V	Firmware revision information
RY	Real year calendar function
SC	Stop code
TA	Tell amplifier status
TB	Tell status
TC	Tell error code
TD	Tell dual encoder
TE	Tell error
TH	Tell handle
TI	Tell input
TP	Tell position
TR	Trace program
TS	Tell switches
TT	Tell torque
TV	Tell velocity
WH	Which handle

#### Programming

BK	Breakpoint
DA	Deallocate variables/arrays
DL	Download program
DM	Dimension arrays
ELSE	Conditional statement
ENDIF	End of cond. statement
EN	End program
HX	Halt execution
IF	If statement
JP	Jump
JS	Jump to subroutine
NO	No-operation—for comments
RA	Record array
RC	Record interval
RD	Record data
RE	Return from error routine
REM	Remark program
RI	Return from interrupt routine
SL	Single step
UL	Upload program
XQ	Execute program
ZA	Data record variables
ZS	Zero stack
'	Comment
#	Label (subroutine)

#### Error Control

BL	Backward software limit
ER	Error limit
FL	Forward software limit
LD	Limit disable
OA	Encoder failure
OE	Off-on-error function

#### Error Control (cont.)

OT	Encoder failure period
OV	Encoder failure voltage
TW	Timeout for in-position

#### Trippoint

AD	After distance
AI	After input
AM	After motion profiler
AP	After absolute position
AR	After relative distance
AS	At speed
AT	After time
MC	Motion complete
MF	After motion—forward
MR	After motion—reverse
WT	Wait for time

#### Independent Motion

AB	Abort motion
AC	Acceleration
BG	Begin motion
DC	Deceleration
FE	Find edge
FI	Find index
HM	Home
HV	Home speed
IP	Increment position
IT	Smoothing time constant
JG	Jog mode
PA	Position absolute
PR	Position relative
PT	Position tracking
SD	Switch deceleration
SP	Speed
ST	Stop

#### Contour Mode

CD	Contour data
CM	Contour mode
DT	Contour time interval

#### PVT Mode

BT	Coordinate start
PV	Position, velocity, time

#### Gearing

GA	Master axis for gearing
GD	Engagement distance for gearing
GM	Gantry mode
_GP	Correction for gearing
GR	Gear ratio for gearing

#### ECAM/Gearing

EA	ECAM master
EB	Enable ECAM
EC	ECAM table index
EG	ECAM go
EM	ECAM modulus
EP	ECAM interval
EQ	Disengage ECAM
ET	ECAM table entry
EW	ECAM widen
EY	ECAM cycle counter

# Pocket Motion Controller & Drive — 1 axis

## DMC-30000 Series

### Connectors

#### DMC-30010

##### J6 Power 4-pin

- 1 -12V
- 2 Ground
- 3 +5V
- 4 +12V

#### DMC-30011

##### J10 Power 2-pin

- 1 Ground
- 2 +VM (9V–48V)

#### DMC-30012/30017

##### J9 Power 2-pin

- 1 Ground
- 2 +VM (20V–80V)

#### DMC-30016

##### J9 Power 2-pin

- 1 Ground
- 2 +VM (12V–30V)

#### DMC-30012/30016/30017

##### J7 Motor Output 4-pin

- 1 Motor Phase C/Motor Phase B-
- 2 Motor Phase B/Motor Phase B+
- 3 NC/Motor Phase A-
- 4 Motor Phase A/Motor Phase A+

#### J4 Encoder 15-pin, Hi-density

##### Female D-sub

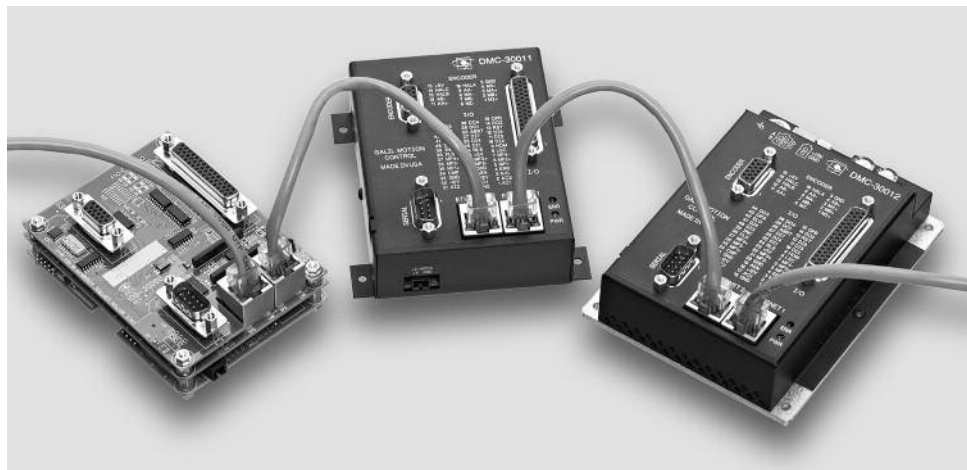
- 1 Index+
- 2 B+
- 3 A+
- 4 Aux B+
- 5 Ground
- 6 Index-
- 7 B-
- 8 A-
- 9 Aux A-
- 10 Hall A
- 11 Aux A+
- 12 Aux B-
- 13 Hall B
- 14 Hall C
- 15 +5V

#### J5 General I/O Axis Connector

- |                       |                                    |                                 |
|-----------------------|------------------------------------|---------------------------------|
| 1 Analog input 1      | 16 Analog Ground                   | 31 Analog input 2               |
| 2 Analog output 2     | 17 Motor command / Analog output 1 | 32 -12V                         |
| 3 NC                  | 18 +12V                            | 33 Ground                       |
| 4 Error output*       | 19 Amp enable                      | 34 Output compare               |
| 5 Multi function 1-** | 20 Ground                          | 35 Multi function 1+**          |
| 6 Multi function 2+** | 21 Multi function 2-**             | 36 Multi function 3-**          |
| 7 Multi function 4-** | 22 Multi function 3+**             | 37 Multi function 4+**          |
| 8 Limit switch common | 23 +5V                             | 38 Forward limit-isolated†      |
| 9 Home-isolated       | 24 Reverse limit-isolated†         | 39 Input common                 |
| 10 Input 2-isolated   | 25 Input 1-isolated                | 40 Input 3-isolated             |
| 11 Input 5-isolated   | 26 Input 4-isolated                | 41 Input 6-isolated             |
| 12 Input 8-isolated   | 27 Input 7-isolated                | 42 Electronic lockout-isolated* |
| 13 Reset-isolated*    | 28 Abort-isolated                  | 43 Output common OPOA           |
| 14 Output 2-isolated  | 29 Output 1-isolated               | 44 Output 3                     |
| 15 Output common OPOB | 30 Output 4-isolated               |                                 |

#### Signal Description for Multi-functional Pins

Label	J5 Pin Number	MT +/-2 or +/-2.5	-SER option with BiSS or SSI Enabled
MF 1+	35	No connect	Main Data+
MF 1-	5	No connect	Main Data-
MF 2+	6	STEP+	Main Clock+
MF 2-	21	STEP-	Main Clock-
MF 3+	22	No connect	Aux Data+
MF 3-	36	No connect	Aux Data-
MF 4+	37	DIR+	Aux Clock+
MF 4-	7	DIR-	Aux Clock-



DMC-30011-CARD, DMC-30011-BOX and DMC-30012-BOX connected by daisy-chained Ethernet ports

\*Active low

\*\*Used for Serial interfaces and Step & Direction outputs

†Configurable for active high or active low

# Pocket Motion Controller & Drive — 1 axis

## DMC-30000 Series

### DMC-30012 Controller & Brushless Sine Drive

The DMC-30012 contains a transconductance, PWM drive for driving brushed/brushless servo motors with sinusoidal commutation. The amplifier drives motors at 20–80 VDC, up to 10 A rms cont., 15 A peak. The gain settings of the amplifier are user-programmable at 0.4 Amp/Volt, 0.8 Amp/Volt and 1.6 Amp/Volt. The switching frequency is 33 kHz. The amplifier offers protection for over-voltage, under-voltage, over-current, and short-circuit. The amplifier status can be read through the controller. The DMC-30012 can support an internal shunt regulator with the -SR option.

### DMC-30016 Controller & 1.4 A Stepper Drive

The DMC-30016 contains a drive for operating a two-phase bipolar stepper motor. The drive is user-configurable from 0.5 A to 1.4 A per phase in 10mA increments at 12–30 VDC and for full-step, half-step, 1/4 step or 1/16 step. No external heatsink is required.

### DMC-30017 Controller & 6 A Microstep Drive

The DMC-30017 contains a microstepping drive for operating a two-phase bipolar stepper motor. The drive produces 256 microsteps per full step or 1024 steps per full cycle which results in 51,200 steps/rev for a standard 200-step motor. The maximum step rate generated by the controller is 3,000,000 microsteps/second. The DMC-30017 drives motors at 20–80 VDC, 6 A/phase. There are four software-selectable current settings: 0.75 A, 1.5 A, 3 A, and 6 A. A selectable low-current mode reduces the current by 75% when the motor is not in motion. No external heatsink is required.

### DMC-31xxx 16-bit ADC & Sinusoidal Encoder Input

The DMC-31xxx model increases the ADC resolution from 12-bits to 16-bits and provides  $\pm 10$  V configurable analog inputs, and accepts sinusoidal encoder signals instead of digital encoder signals. The DMC-31xxx interpolates a 1-volt differential sinusoidal encoder resulting in a higher position resolution. The AFn command selects sinusoidal interpolation where n specifies  $2^n$  interpolation counts per encoder cycle (n=5 to 12). For example, if the encoder cycle is 40 microns, AF10 results in  $2^{10}=1024$  counts per cycle, or a resolution of 39 nanometers per count.

## Ordering Information

PART NUMBER	DESCRIPTION	QUANTITY 1	QUANTITY 100
DMC-30010-CARD	Controller card without DC-to-DC	\$ 495	\$ 295
DMC-30011-CARD	Controller card with DC-to-DC	\$ 545	\$ 330
DMC-30010-BOX	Controller box without DC-to-DC	\$ 545	\$ 330
DMC-30011-BOX	Controller box with DC-to-DC	\$ 595	\$ 365
DMC-30012-BOX	Controller box with 800 W brushless sine drive	\$ 695	\$ 445
DMC-30016-BOX	Controller box with stepper drive; 1,4 A/phase; 12–30 VDC	\$ 645	\$ 415
DMC-30017-BOX	Controller box with microstepping drive; 6 A/phase; 20–80 VDC	\$ 745	\$ 480
DMC-31xxx	16-bit ADC and $\pm 10$ V configurable analog inputs; sinusoidal encoder. Ordering example: DMC-31010, DMC-31011, DMC-31012 or DMC-31017	add \$ 100	add \$ 65
-HSRC (or -HSNK)	High-power sourcing (or sinking) outputs $\pm 500$ mA	add \$ 25	
-SER	SSI and BiSS encoder option	add \$ 50	add \$ 25
-SR	Shunt regulator for drive option	add \$ 50	add \$ 25
-RTC	Real time clock option	add \$ 50	add \$ 25
ICS-48015-M	15-pin D HD male to screw terminals for encoder signals	\$ 50	\$ 35
ICS-48044-M	44-pin D HD male to screw terminals for general I/O	\$ 75	\$ 50
Cable-15-1m	15-pin D to discrete wires—1 meter	\$ 25	\$ 17
Cable-44-1m	44-pin D to discrete wires—1 meter	\$ 35	\$ 24
PCable-2pin-1m	Power cable for 12, 24 or 48 V—1 meter	\$ 10	
PCable-4pin-1m	Power cable for 5, $\pm 12$ V and ground —1 meter	\$ 10	
GalilTools-Lite	Editor, Terminal, Watch tools. Includes communication library for developers-supports C++, VB, C#, LabVIEW and more	Free download	
GalilTools	Above with Scope and Tuner	\$ 195	
FAS	Frequency analysis software for servo tuning in frequency domain	\$ 195	

*Galil offers additional quantity discounts for purchases between 1 and 100. Consult Galil for a quotation.*