

# Ethernet/RS232, 1- and 2-axis

## DMC-14x5 Series

### Product Description

The DMC-1415 and DMC-1425 are economical, one and two axis motion controllers with an Ethernet 10Base-T and RS232 port. The DMC-34x5 is designed for Ethernet-based distributed systems where one DMC-34x5 controller is designated as the master over other DMC-34x5 controllers. Controllers are available as a card-level product or in a metal enclosure with power supply.

With a 32-bit microcomputer, the single and dual axis controllers provide such advanced features as PID compensation with velocity and acceleration feedfor-

DMC-14x5 Controller



ward, program memory with multitasking for simultaneously running two applications programs, and uncommitted I/O for synchronizing motion with external events. It handles various modes of motion including point-to-point positioning, jogging, con-

touring, electronic gearing and ECAM. The DMC-1415 or -3415 single-axis controller accepts inputs from two encoders, which is useful for electronic gearing applications. The DMC-1425 or -3425 dual-axis controller includes linear and circular interpolation for precise, coordinated motion.

Like all Galil controllers, the DMC-14x5 and -34x5 controllers use a simple, English-like command language which makes them very easy to program. Galil's WSDK servo design software further simplifies system set-up with "one-button" servo tuning and real-time display of position and velocity information. Communication drivers are available for Windows, .NET, QNX, and Linux.

### Features

- Card-level and box-level, stand-alone motion controllers
- DMC-1415 or DMC-3415: 1-axis card or box  
DMC-1425 or DMC-3425: 2-axis card or box
- Ethernet 10BASE-T and one RS232 port up to 19.2 kb.
- Ethernet supports multiple masters and slaves
- The DMC-1425, -3425 controls two servos or two steppers
- Accepts up to 12 MHz encoder frequencies for servos.  
Outputs up to 3 MHz for steppers
- Advanced PID compensation with velocity and acceleration feedforward, offsets, notch filter and integration limits
- Modes of motion include jogging, point-to-point positioning, contouring, electronic gearing and ECAM. Accepts input from auxiliary encoder for DMC-1415, -3415 only. Linear and circular interpolation for DMC-1425, -3425 only.
- Over 200 English-like commands directly executable by controller. Includes conditional statements and event triggers
- Non-volatile memory for programs, variables and arrays. Concurrent execution of two application programs
- Home input and forward and reverse limits
- 2 uncommitted analog inputs with 12-bit ADC
- DMC-1415, -3415: 7 Uncommitted digital inputs, 3 digital outputs  
DMC-1425, -3425: 3 Uncommitted digital inputs, 3 digital outputs
- High-speed position latch
- Use Galil's IOC-7007 or DB-14064 for additional I/O
- Uses 37-pin D connector. ICM-1460 interconnect module breaks-out 37-pin cable into screw terminals
- DMC-14x5, -34x5-Card accepts +5 V,  $\pm 12$  V;  
DMC-14x5, -34x5-BOX accepts 90–260 VAC
- Compact size:  
DMC-14x5, -34x5-CARD: 3.75" x 5.0"  
DMC-14x5, -34x5-BOX: 5.1" x 3.0" x 6.8"
- Communication drivers for Windows, QNX, and Linux
- CE certified
- Custom hardware and firmware options available

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## DMC-14x5 Series

### Specifications

#### System Processor

- Motorola 32-bit microcomputer

#### Communications Interface

- Ethernet BASE-T and RS232 port up to 19.2k baud

#### Modes of Motion:

- Point-to-point positioning
- Jogging
- Electronic Gearing
- Electronic Cam
- Contouring
- Linear and circular interpolation for DMC-1425, -3425

#### Memory

- Program memory size—500 lines × 80 characters
- 126 variables
- 2000 array elements in up to 14 arrays

#### Filter

- PID (proportional-integral-derivative) with velocity and acceleration feedforward
- Notch filter
- Dual-loop control for backlash compensation (DMC-1415, -3415 only)
- Velocity smoothing to minimize jerk
- Integration limits
- Torque limits
- Offset adjustment
- Option for piezo-ceramic motors

#### Kinematic Ranges

- Position: 32 bit ( $\pm 2.15$  billion counts per move; automatic rollover; no limit in jog or vector modes)
- Velocity: Up to 12 million counts/sec for servo motors
- Acceleration: Up to 67 million counts/sec<sup>2</sup>

#### Uncommitted Digital I/O

- DMC-1415/3415: 7 buffered inputs; 3 TTL outputs\*
- DMC-1425, -3425: 3 buffered inputs; 3 TTL outputs\*
- DB-14064: Configurable 64 TTL I/O

#### Uncommitted Analog Inputs

- 2 individual  $\pm 10$  V analog inputs with 12-bit resolution (16-bit optional)

#### High Speed Position Latch

- Latches within 0.1 microseconds

#### Dedicated I/O

- Main encoder inputs—Channel A, A-, B, B-, I, I- ( $\pm 12$  V or TTL)
- Auxiliary encoder—Channel A, A-, B, B- (not available on DMC-1425, -3425)
- Forward and reverse limit inputs—buffered\*
- Home input—buffered\*
- High-speed position latch input—buffered\*
- Analog motor command output with 16-bit DAC resolution
- Pulse and direction output for step motors
- Amplifier enable output
- Error output
- Encoder output compare

#### Minimum Servo Loop Update Time

- 250 microseconds
- 125 microseconds with fast firmware (DMC-14x5)

#### Maximum Encoder Feedback Rate

- 12 MHz

#### Maximum Stepper Rate

- 3 MHz (Full, half or microstep)

#### Power Requirements

- DMC-1415 and DMC-1425 cards:
  - +5 V 400 mA
  - 12 V 40 mA
  - +12 V 40 mA
- DMC-1415/1425/34x5 Box: accepts 90–260 V AC 50/60 Hz supply

#### Environmental

- Operating temperature: 0–70° C for card; 0–60° C for box
- Humidity: 20–95% RH, non-condensing

#### Mechanical

- DMC-14x5, -34x5 cards: 3.75" × 5.0"
- DMC-14x5, -34x5 boxes: 5.1" × 6.8" × 3.0"

#### Connectors

- 37-pin D-type

\*Optically isolated I/O available with ICM-1460-OPTO option.

### Instruction Set

#### Servo Motor

AF	Analog feedback
DV	Dual loop operation (1415)
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
SH	Servo here
TL	Torque limit
TM	Sample time

#### Stepper Motor

DE	Define encoder position
DP	Define reference position
KS	Stepper motor smoothing
MT	Motor type
RP	Report commanded position
TD	Step counts output
TP	Tell position of encoder

#### Brushless Motor (-1415, -3415 only)

BA	Brushless axis
BB	Brushless phase
BC	Brushless calibration
BD	Brushless degrees
BI	Brushless inputs
BM	Brushless modulo
BO	Brushless offset
BS	Brushless setup
BZ	Brushless zero

#### I/O Commands

AL	Arm latch
AO	Set analog voltage
CB	Clear bit
CI	Communication interrupt
II	Input interrupt
OB	Define output bit
OC	Output compare function
OP	Output port
SB	Set bit
@IN[x]	State of digital input x
@OUT[x]	State of digital output x
@AN[x]	Value of analog input x

#### System Configuration

BN	Burn parameters
BP	Burn program
BV	Burn variables and arrays
CE	Configure encoder type

#### System Configuration (cont.)

CF	Configure unsolicited messages
CN	Configure switches
CO	Configure I/O points
CW	Data adjustment bit
DE	Define dual encoder position
DP	Define position
EO	Echo off
IA	Set IP address
IH	Internet handle
IK	Ethernet port blocking
IT	Independent smoothing
LZ	Leading zeros format
MB	ModBus
MO	Motor off
MT	Motor type
PF	Position format
QD	Download array
QU	Upload array
^R^S	Master reset
VF	Variable format

#### Math Functions

@SIN[x]	Sine of x
@COS[x]	Cosine of x
@COM[x]	1's complement of x
@ASIN[x]	Arc sine of x
@ACOS[x]	Arc cosine of x
@ATAN[x]	Arc tangent of x
@ABS[x]	Absolute value of x
@FRAC[x]	Fraction portion of x
@INT[x]	Integer portion of x
@RND[x]	Round of x
@SQR[x]	Square root of x

#### Interrogation

LA	List arrays
LL	List labels
LS	List program
LV	List variables
MG	Message command
QR	Data record
QZ	Return data record
RP	Report command position
RL	Report latch
^R^V	Firmware revision information
SC	Stop code
TB	Tell status
TC	Tell error code
TD	Tell dual encoder
TE	Tell error
TH	Tell Ethernet handle
TI	Tell input
TIME	Time operand
TP	Tell position

#### Interrogation (cont.)

TR	Trace program
TS	Tell switches
TT	Tell torque
TV	Tell velocity
TZ	Tell I/O configuration
WH	Which handle

#### Programming

BK	Breakpoint
DA	Deallocate variables/arrays
DL	Download program
DM	Dimension arrays
ED	Edit program
ELSE	Conditional statement
ENDIF	End of cond. statement
EN	End program
HX	Halt execution
IF	If statement
IN	Input variable
JP	Jump
JS	Jump to subroutine
NO	No-operation—for comments
RA	Record array
RC	Record interval for RA
RD	Record data for RA
RE	Return from Error
REM	Remark program
RI	Return from interrupt
SA	Send command
SL	Single step
UL	Upload program
XQ	Execute program
ZS	Zero stack
'	Comment

#### Error Control

BL	Backward software limit
ER	Error limit
FL	Forward software limit
OE	Off-on-error function
TL	Torque limit
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
AV	After vector distance
MC	Motion complete
MF	After motion—forward
MR	After motion—reverse

#### Trippoint (cont.)

WC	Wait for contour data
WT	Wait for time

#### Independent Motion

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

#### Contour Mode

CD	Contour data
CM	Contour mode
DT	Contour time interval
WC	Wait for contour data

#### ECAM/Gearing

EA	ECAM master
EB	Enable ECAM
EC	ECAM table index
EG	ECAM go
EM	ECAM cycle
EP	ECAM interval
EQ	Disengage ECAM
ET	ECAM table entry
GA	Master axis for gearing
GM	Gantry mode
GR	Gear ratio for gearing

#### Vector/Linear Interpolation (DMC-1425, -3425 only)

CR	Circular interpolation move
CS	Clear motion sequence
ES	Ellipse scaling
LE	Linear interpolation end
LI	Linear interpolation segment
LM	Linear interpolation mode
ST	Stop motion
VA	Vector acceleration
VD	Vector deceleration
VE	Vector sequence end
VM	Coordinated motion mode
VP	Vector position
VR	Vector speed ratio
VS	Vector speed
VT	Smoothing time constant—vector

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### Hardware Accessories

#### ICM-1460

The ICM-1460 Interconnect Module provides a breakout to screw terminals for the 37-pin D-type cable from the DMC-14x5 or 34x5 for quick connection of system hardware. The ICM-1460 is contained in a metal enclosure with dimensions of 6.9" × 4.9" × 2.6" and 0.2" diameter keyholes for mounting. The ICM is normally shipped configured for high amp enable, +5 V (-HAEN). For low amp enable, order ICM-1460-LAEN.

#### ICM-1460 OPTO

For applications requiring optoisolation, the ICM-1460 "OPTO" option provides 5–24 V optoisolation on all general inputs and outputs, home inputs, limits, and abort input.



*ICM-1460 Interconnect Module  
(shown with and without cover)*

#### DB-14064 I/O Expansion

The DB-14064 is an optional board which provides 64 additional I/O for the DMC-14x5 or 34x5 controller cards. This board mounts directly onto the back of the controller and provides 64 I/O points configurable by the user for inputs or outputs. The I/O is accessible through two 50-pin headers.

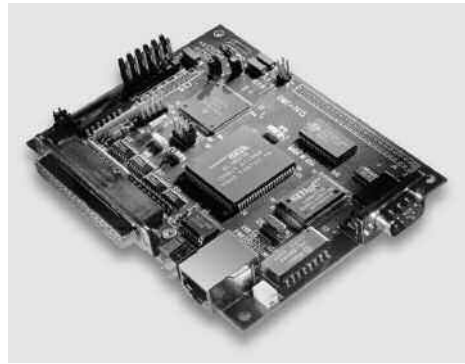
#### DMC-34x5 Distributed Control Option

The DMC-34x5 Series distributed control system can operate with a single communication channel between the host and the master controller. This master controller is programmed to maintain communication with each slave. Commands sent by the host computer to the master controller are based on the multi-axis convention designating the axes as A, B, C, D, E, F, G, H.

The individual slave controllers can contain their own local application program. A slave program would be written to act as if the slave was operating independent of the distributed control network.

In most cases, the programming is done on a multi-axis level to simplify the programming. An application program written at the multi-axis level can command all axes of motion and apply trippoints to all axes. On the other hand, a slave controller program can drive only the local motors and include trippoints which refer to the local axes.

The multi-axis network may be configured automatically with the HC command. This single command is used to configure the number of axes, data update rate and number of IOC devices in the system. DMC-3415



and DMC-3425 controllers may be used in any combination for a total of up to 8 axes in the network.

*DMC-3425*

#### AMP-14110 1-axis and AMP-14120 2-axis 20W Servo Drives

The AMP-14110 and AMP-14120 are one-axis and two-axis linear drives for operating small brush-type servo motors. The AMP-14110 mounts directly to the DMC-1415 1-axis controller and the AMP-14120 mounts to the DMC-1425 2-axis controller. The amplifiers require a  $\pm 12$ –30 VDC input. Output power is 20W per amplifier. The gain of each transconductance linear amplifier is 0.1 A/V at 1 A maximum current. The typical current loop bandwidth is 4 kHz. 100 mA maximum current is available as an option.

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## DMC-14x5 Series

### Connectors

#### DMC-1415, 3415 J3

Main 37-pin D-type

1 Reset* (TTL)	20 Error*
2 Amp enable	21 ACMD (STEP for Stepper Motor)
3 Output 3	22 Output 2
4 Output 1	23 Output compare
5 Analog Input 1	24 Analog Input 2
6 Input 7	25 Input 6
7 Input 5	26 Input 4
8 Input 3	27 Input 2
9 Input 1 (and latch)	28 Forward limit
10 +5V	29 Reverse limit
11 Ground	30 Home
12 +12V	31 -12V
13 Ground	32 Main Encoder A+
14 Main Encoder A-	33 Main Encoder B+
15 Main Encoder B-	34 Main Encoder I+
16 Main Encoder I-	35 Auxiliary A+
17 Auxiliary A-	36 Auxiliary B+
18 Auxiliary B-	37 Abort*
19 ACMD Phase B (DIR for Stepper Motor) (For Sinusoidal Commutation)	

#### DMC-1425, -3425 J3

Main 37-pin D-type

1 Reset*	20 Error*
2 Amp Enable (both motors)	21 ACMDX/STEPX
3 Output 3	22 Output 2
4 Output 1	23 Output compare
5 Analog 1	24 Analog 2
6 Index Y	25 Home Y
7 Reverse limit Y	26 Forward limit Y
8 Input 3	27 Input 2 (Y latch input)
9 Input 1 (X latch input)	28 Forward limit X
10 +5V	29 Reverse limit X
11 Ground	30 Home X
12 +12V	31 -12V
13 Ground	32 X Encoder A+
14 X Encoder A -	33 X Encoder B+
15 X Encoder B -	34 X Encoder I+
16 X Encoder I -	35 Y Encoder A+
17 Y Encoder A -	36 Y Encoder B +
18 Y Encoder B -	37 Abort*
19 ACMDY/DIRX	

\*Active low

### Ordering Information

PART NUMBER	DESCRIPTION	QUANTITY 1	QUANTITY 100
<b>DMC-1415-card (or -3415)</b>	1-axis stand-alone with Ethernet & RS232	\$ 595	\$ 395
<b>DMC-1415-box (or -3415)</b>	DMC-1415 in enclosure with power supply	\$ 795	\$ 545
<b>DMC-1425-card (or -3425)</b>	2-axis controller for 2 servo motors	\$ 695	\$ 445
<b>DMC-1425-box (or -3425)</b>	DMC-1425 in enclosure with power supply	\$ 895	\$ 595
<b>-STEPPER option</b>	Controls 2 step motors instead of 2 servo motors	No extra charge	
<b>CABLE 37-pin D</b>	37-pin D-type cable	\$ 25	
<b>ICM-1460</b>	Interconnect Module. Specify -HAEN for high amp enable or -LAEN for low amp enable	\$ 145	\$ 95
<b>ICM-1460-STEPPER</b>	Interconnect for DMC-1425-STEPPER	\$ 145	\$ 95
<b>ICM-1460-OPTO</b>	ICM with optoisolated inputs and outputs	\$ 195	\$ 145
<b>AMP-14110</b>	1-axis 20W servo amplifier board for DMC-1415-card	\$ 75	\$ 55
<b>AMP-14120</b>	2-axis 20W servo amplifier board for DMC-1425-card	\$ 125	\$ 105
<b>DB-14064</b>	Expansion board for 64 I/O (for card-level only)	\$ 295	\$ 195
<b>Galil Utilities</b>	Communication drivers, SmartTERM, DMCDOS	\$ 20 for CD; free download	
<b>DMCWIN32</b>	Windows API Tool Kit (VB, C, C++, etc.)	Included with Utilities	
<b>WSDK</b>	Set-up, tuning and analysis software	\$ 195	
<b>ActiveX Tool Kit</b>	Custom ActiveX controls for Microsoft platforms	\$ 595	

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