

Ethernet/RS232 and USB/RS232 Optima 1–8 axes

DMC-20x0, DMC-21x0 and DMC-22x0 Series

Product Description

The DMC-20x0, DMC-21x0, and DMC-22x0 Series are box-level, multi-axis controllers designed for stand-alone applications. The controllers differ only in their type of communication interface: the DMC-20x0 has USB; the DMC-21x0 has an Ethernet 10Base-T port and the DMC-22x0 has an Ethernet 10/100Base-T port. All controllers also include two RS232 serial ports. The DMC-20x0, DMC-21x0 and DMC-22x0 controllers are available for 1 through 8 axes.

The DMC-2xx0 controllers incorporate a 32-bit microcomputer and provide such advanced features as PID compensation with velocity and acceleration feedforward, programmable notch, program memory with multitasking for simultaneously running up to eight application programs, and uncommitted I/O for synchronizing motion with external events. They handle various modes of motion including point-to-point positioning, jogging, linear and circular interpolation, contouring, electronic gearing and ECAM. Additionally, the controllers are user-configurable for stepper or servo motor control on any combination of axes.

Like all Galil controllers, the DMC-2xx0 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 DOS, Linux and all current Windows operating systems.

DMC-21x0 Stand-alone with Ethernet/RS232



Features

- Box-level, stand-alone motion controllers
- Available in 1 through 8 axis versions: where $x=1,2,3,4,5,6,7,8$ axes
- Two RS232/422 ports up to 115kb
- DMC-20x0: USB
DMC-21x0: Ethernet 10Base-T
DMC-22x0: Ethernet 10/100 Base-T
- Ethernet supports multiple masters and slaves. TCP/IP, UDP and ModBus protocol for communication with I/O
- User-configurable for stepper or servo motors on any combination of axes. Optional firmware for piezo-ceramic motors. Sinusoidal commutation for brushless servo motors
- 12 MHz encoder frequencies for servos; 3 MHz 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. Features ellipse scaling, slow-down around corners, infinite segment feed and feedrate override
- 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 up to eight application programs
- Dual encoders, home and limits for each axis
- 8 isolated uncommitted inputs and 8 outputs for 1- through 4-axis models, 16 in/16 out for 5- through 8-axis models
- High speed position latch and output compare for each axis
- 8 uncommitted analog inputs
- Additional 64 configurable digital I/O
- Use Galil's IOC-7007 I/O controller for additional I/O
- 100-pin SCSI connectors for each set of 4 axes. Galil's ICM-2900 interconnect module breaks-out 100-pin cable into screw terminals and attaches directly to DMC-2xx0 metal enclosure
- 12.1" x 2.2" x 6.3" metal enclosure; Accepts 90-250V AC
- CE certified
- Custom hardware and firmware options available

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Specifications

System Processor

- Motorola 32-bit microcomputer

Communications Interface

- DMC-2000: USB 12 Mb/s, expansion hub with two ports.
(2) RS232/422 ports up to 115 kb. RS485 option
- DMC-2100: Ethernet 10BASE-T (10BASE-F is available as an option).
(2) RS232/422 ports up to 115 kb. RS485 option
- DMC-2200: Ethernet 100BASE-T. (2) RS232/422 ports up to 115 kb.
RS485 option

Commands are sent in ASCII. A binary communication mode is also available as a standard feature

Modes of Motion:

- Point-to-point positioning
- Jogging
- 2D Linear and Circular Interpolation with feedrate override
- Linear Interpolation for up to 8 axes
- Tangential Following
- Helical
- Electronic Gearing with multiple masters
- Gantry Mode
- Electronic Cam
- Contouring
- Teach and playback

Memory

- Program memory size—1000 lines $\times$ 80 characters
- 254 variables
- 8000 array elements in up to 30 arrays

Filter

- PID (proportional-integral-derivative) with velocity and acceleration feedforward
- Notch filter and low-pass filter
- Dual-loop control for backlash compensation
- Velocity smoothing to minimize jerk
- Integration limits
- Torque limits
- Offset adjustments
- Option for piezo-ceramic motors

Kinematic Ranges

- Position: 32 bit (± 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/sec²

Uncommitted Digital I/O

	DIGITAL INPUTS	DIGITAL OUTPUTS	CONFIGURABLE I/O
DMC-2x10 thru -2x40	8	8	64
DMC-2x50 thru -2x80	16	16	64

Uncommitted Analog Inputs

- 8 individual ± 10 V analog inputs with 12-bit resolution
(16-bit available as an option)

High Speed Position Latch

- Uncommitted inputs 1–4 latch X, Y, Z, W, and 9–12 latch E, F, G, H axes (latches within 0.1 microsecond without optoisolation and within 40 microseconds with optoisolation)

Dedicated Inputs (per axis)

- Main encoder inputs—Channel A, A-, B, B-, I, I- (± 12 V or TTL)
- Auxiliary encoder (for axes configured as servo)—Channel A, A-, B, B-
- Forward and reverse limit inputs—optoisolated
- Home input—optoisolated
- Selectable high-speed position latch input
- Selectable abort input

Dedicated Outputs (per axis)

- Analog motor command output with 16-bit DAC resolution
- Pulse and direction output for step motors
- PWM output also available for servo amplifiers
- Amplifier enable output
- Error output
- High-speed position compare output (1 output for each set of 4 axes)

Minimum Servo Loop Update Rate

- 1–2 axes: 125 microseconds
- 3–4 axes: 250 microseconds
- 5–6 axes: 375 microseconds
- 7–8 axes: 500 microseconds

Maximum Encoder Feedback Rate

- 12 MHz

Maximum Stepper Rate

- 3 MHz (Full, half or microstep)

Power Requirements

- DMC-2xx0 series: accepts 90–250 V AC, 50–60 Hz

Environmental

- Operating temperature: 0–70° C
- Humidity: 2–95% RH, non-condensing

Mechanical

- DMC-2xx0 series: 1–8 axes, 12.1" $\times$ 2.2" $\times$ 6.3" metal enclosure

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Instruction Set

Servo Motor

AF	Analog feedback
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
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

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

AL	Arm latch
AO	Analog output
CB	Clear bit
CI	Communication Interrupt
CO	Configure I/O points
II	Input interrupt
OB	Define output bit
OC	Output compare function
OP	Output port
SB	Set bit

System Configuration

BN	Burn parameters
BP	Burn program
BV	Burn variables and arrays
CC	Configure auxiliary port
CE	Configure encoder type
CN	Configure switches
CO	Configure I/O points
CW	Data adjustment bit
DE	Define dual encoder position
DP	Define position
DV	Dual velocity (dual loop)
EI	Enable interrupts
EO	Echo off
IA	Set IP address
IH	Internet handle
IT	Independent smoothing
LZ	Leading zeros format
MB	ModBus
MO	Motor off
MT	Motor type
PF	Position format
QD	Download array
QU	Upload array
RS	Reset
*R*S	Master reset
VF	Variable format

Math/Special Functions

@SIN[x]	Sine of x
@COS[x]	Cosine of x
@COM[x]	1's compliment 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
@IN[x]	State of digital input x
@OUT[x]	State of digital output x
@AN[x]	Value of analog input x

Interrogation

LA	List arrays
LL	List labels
LS	List program
LV	List variables
MG	Message command
QR	Data record
QZ	Return DMA information
RP	Report command position
RL	Report latch
*R*V	Firmware revision information
SC	Stop code

Interrogation Commands (cont.)

TB	Tell status
TC	Tell error code
TD	Tell dual encoder
TE	Tell error
TI	Tell input
TP	Tell position
TR	Trace program
TS	Tell switches
TT	Tell torque
TV	Tell velocity

Programming

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 remarks
RA	Record array
RC	Record interval
RD	Record data
REM	Remark program
UL	Upload program
ZS	Zero stack

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
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

CA	Define vector plane
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
TN	Tangent
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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Connectors

100-pin, high density; Connector: Amp# 2-178238-9; Cable: Amp# 2-175677-9; Enclosure: Amp# 176793-9

Axis 1–4 DMC-2xx0

1 Analog ground	51 NC
2 Ground	52 Ground
3 5 V	53 5 V
4 Error output	54 Limit common
5 Reset	55 Home W
6 Encoder—compare output	56 Reverse limit W
7 Ground	57 Forward limit W
8 Ground	58 Home Z
9 Motor command W	59 Reverse limit Z
10 Sign W / dir W	60 Forward limit Z
11 PWM W / step W	61 Home Y
12 Motor command Z	62 Reverse limit Y
13 Sign Z / dir Z	63 Forward limit Y
14 PWM Z / step Z	64 Home X
15 Motor command Y	65 Reverse limit X
16 Sign Y / dir Y	66 Forward limit X
17 PWM Y / step Y	67 Ground
18 Motor command X	68 5 V
19 Sign X / dir X	69 Input common
20 PWM X / step X	70 Latch X/Input 1
21 Amp enable W	71 Latch Y/Input 2
22 Amp enable Z	72 Latch Z/Input 3
23 Amp enable Y	73 Latch W/Input 4
24 Amp enable X	74 Input 5
25 A+ X	75 Input 6
26 A- X	76 Input 7
27 B+ X	77 Input 8
28 B- X	78 Abort
29 I+ X	79 Output 1
30 I- X	80 Output 2
31 A+ Y	81 Output 3
32 A- Y	82 Output 4
33 B+ Y	83 Output 5
34 B- Y	84 Output 6
35 I+ Y	85 Output 7
36 I- Y	86 Output 8
37 A+ Z	87 5 V
38 A- Z	88 Ground
39 B+ Z	89 Ground
40 B- Z	90 Ground
41 I+ Z	91 Analog in 1
42 I- Z	92 Analog in 2
43 A+ W	93 Analog in 3
44 A- W	94 Analog in 4
45 B+ W	95 Analog in 5
46 B- W	96 Analog in 6
47 I+ W	97 Analog in 7
48 I- W	98 Analog in 8
49 +12 V	99 -12 V
50 +12 V	100 -12 V

Axis 5–8 DMC-2xx0

1 NC	51 NC
2 Ground	52 Ground
3 5 V	53 5 V
4 Error output	54 Limit common
5 Reset	55 Home H
6 Encoder—compare output	56 Reverse limit H
7 Ground	57 Forward limit H
8 Ground	58 Home G
9 Motor command H	59 Reverse limit G
10 Sign H / dir H	60 Forward limit G
11 PWM H / step H	61 Home F
12 Motor command G	62 Reverse limit F
13 Sign G / dir G	63 Forward limit F
14 PWM G / step G	64 Home E
15 Motor command F	65 Reverse limit E
16 Sign F / dir F	66 Forward limit E
17 PWM F / step F	67 Ground
18 Motor command E	68 5 V
19 Sign E / dir E	69 Input common
20 PWM E / step E	70 Latch E/Input 9
21 Amp enable H	71 Latch F/Input 10
22 Amp enable G	72 Latch G/Input 11
23 Amp enable F	73 Latch H/Input 12
24 Amp enable E	74 Input 13
25 A+ E	75 Input 14
26 A- E	76 Input 15
27 B+ E	77 Input 16
28 B- E	78 Abort
29 I+ E	79 Output 9
30 I- E	80 Output 10
31 A+ F	81 Output 11
32 A- F	82 Output 12
33 B+ F	83 Output 13
34 B- F	84 Output 14
35 I+ F	85 Output 15
36 I- F	86 Output 16
37 A+ G	87 5 V
38 A- G	88 Ground
39 B+ G	89 Ground
40 B- G	90 Ground
41 I+ G	91 NC
42 I- G	92 NC
43 A+ H	93 NC
44 A- H	94 NC
45 B+ H	95 NC
46 B- H	96 NC
47 I+ H	97 NC
48 I- H	98 NC
49 +12 V	99 -12 V
50 +12 V	100 -12 V

Auxiliary Encoder DMC-2xx0

36-pin, high density
Connector: Amp# 2-178238-5
Cable: Amp#2-175677-5
Enclosure: Amp# 176793-5

1 5 V	19 5 V
2 Ground	20 Ground
3 +aa X	21 +aa E
4 -aa X	22 -aa E
5 +ab X	23 +ab E
6 -ab X	24 -ab E
7 +aa Y	25 +aa F
8 -aa Y	26 -aa F
9 +ab Y	27 +ab F
10 -ab Y	28 -ab F
11 +aa Z	29 +aa G
12 -aa Z	30 -aa G
13 +ab Z	31 +ab G
14 -ab Z	32 -ab G
15 +aa W	33 +aa H
16 -aa W	34 -aa H
17 +ab W	35 +ab H
18 -ab W	36 -ab H

RS-232-Main Port DMC-2x00

9 pin; Male connector and cable

1 CTS—output	6 CTS—output
2 Transmit data—output	7 RTS—input
3 Receive data—input	8 CTS—output
4 RTS—input	9 NC
5 Ground	

RS-232-Auxiliary Port DMC-2x00

9-pin; Female connector and cable

1 CTS—input	6 CTS—input
2 Transmit data—input	7 RTS—output
3 Receive data—output	8 CTS—input
4 RTS—output	9 5 V
5 Ground	

USB-In DMC-2000

Series B, 4 pos; Connector: Amp# 787780-1

USB-Out DMC-2000

Series A, 8 pos; Connector: Amp# 787617-1

Ethernet 10BASE-T DMC-2100

RJ-45 connector

Ethernet 100BASE-T DMC-2200

RJ-45 connector

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Extended I/O DMC-2x00

80-pin, high density

Connector: 3M# n10280-52e2vc

Cable: Amp# 3-175677-0

Enclosure: Amp# 1-176793-0

1 Bit 7 - bank 6	41 Bit 7 - bank 2
2 Bit 0 - bank 7	42 Bit 0 - bank 3
3 Bit 6 - bank 6	43 Bit 6 - bank 2
4 Bit 1 - bank 7	44 Bit 1 - bank 3
5 Bit 5 - bank 6	45 Bit 5 - bank 2
6 Bit 2 - bank 7	46 Bit 2 - bank 3
7 Bit 4 - bank 6	47 Bit 4 - bank 2
8 Bit 3 - bank 7	48 Bit 3 - bank 3
9 Bit 3 - bank 6	49 Bit 3 - bank 2
10 Bit 4 - bank 7	50 Bit 4 - bank 3
11 Bit 2 - bank 6	51 Bit 2 - bank 2
12 Bit 5 - bank 7	52 Bit 5 - bank 3
13 Bit 1 - bank 6	53 Bit 1 - bank 2
14 Bit 6 - bank 7	54 Bit 6 - bank 3
15 Bit 0 - bank 6	55 Bit 0 - bank 2
16 Bit 7 - bank 7	56 Bit 7 - bank 3
17 Bit 7 - bank 5	57 Bit 7 - bank 1
18 Ground	58 Ground
19 Bit 6 - bank 5	59 Bit 6 - bank 1
20 Ground	60 Ground
21 Bit 5 - bank 5	61 Bit 5 - bank 1
22 Ground	62 Ground
23 Bit 4 - bank 5	63 Bit 4 - bank 1
24 Ground	64 Ground
25 Bit 3 - bank 5	65 Bit 3 - bank 1
26 Ground	66 Ground
27 Bit 2 - bank 5	67 Bit 2 - bank 1
28 Ground	68 Ground
29 Bit 1 - bank 5	69 Bit 1 - bank 1
30 Ground	70 Ground
31 Bit 0 - bank 5	71 Bit 0 - bank 1
32 Bit 7 - bank 4	72 Bit 7 - bank 0
33 Bit 6 - bank 4	73 Bit 6 - bank 0
34 Bit 5 - bank 4	74 Bit 5 - bank 0
35 Bit 4 - bank 4	75 Bit 4 - bank 0
36 Bit 3 - bank 4	76 Bit 3 - bank 0
37 Bit 2 - bank 4	77 Bit 2 - bank 0
38 Bit 1 - bank 4	78 Bit 1 - bank 0
39 Bit 0 - bank 4	79 Bit 0 - bank 0
40 5V	80 5V

Hardware Accessories

ICM-2900 Interconnect Module for DMC-2x00

The ICM-2900 interconnect module for the DMC-2x00 mounts directly to the DMC-2000 enclosure.

Use one for every four axes. The ICM-2900 accepts the 100-pin motion controller cable for break-out into screw terminals.

ICM-2908 Interconnect Module for Auxiliary Encoders

The ICM-2908 interconnect module for the DMC-2x00 accepts the 36-pin cable for auxiliary encoders.

One ICM-2908 may be used for up to eight axes.



Left: ICM-2900
Interconnect Module
Center: DMC-2040
with attached ICM-2900
Right: ICM-2908

IOM-1964 I/O Module

The IOM-1964 is an Input/Output module that provides optical isolation for the 64 extended I/O of the DMC-2x00 controllers. Each of the 64 optically isolated inputs and outputs is rated for 25mA at up to 28 VDC and is configurable as inputs or outputs in groups of eight bits. The IOM-1964 also provides 16 highside outputs capable of 500 mA of current per output. The dimensions are 6.8" × 11.4".



IOM-1964 Optically Isolated 64-bit
Input/Output Module

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Ordering Information

PART NUMBER	DESCRIPTION	QUANTITY 1	QUANTITY 100
DMC-2010 (or 2110)	1-axis USB, RS232 (or 1-axis Ethernet 10BASE-T*, RS232)	\$1595	\$ 995
DMC-2020 (or 2120)	2-axis USB, RS232 (or 2-axis Ethernet 10BASE-T*, RS232)	\$1995	\$1145
DMC-2030 (or 2130)	3-axis USB, RS232 (or 3-axis Ethernet 10BASE-T*, RS232)	\$2395	\$1195
DMC-2040 (or 2140)	4-axis USB, RS232 (or 4-axis Ethernet 10BASE-T*, RS232)	\$2595	\$1295
DMC-2050 (or 2150)	5-axis USB, RS232 (or 5-axis Ethernet 10BASE-T*, RS232)	\$2895	\$1445
DMC-2060 (or 2160)	6-axis USB, RS232 (or 6-axis Ethernet 10BASE-T*, RS232)	\$3095	\$1545
DMC-2070 (or 2170)	7-axis USB, RS232 (or 7-axis Ethernet 10BASE-T*, RS232)	\$3295	\$1645
DMC-2080 (or 2180)	8-axis USB, RS232 (or 8-axis Ethernet 10BASE-T*, RS232)	\$3495	\$1745
DMC-22x0	Ethernet 10/100BASE-T, RS232 <i>*100BASE-F/10BASE-F fiberoptic link is available as an option.</i>	Same as DMC-21x0 prices	
ICM-2900	Interconnect module (use 1 for every 4 axes). Specify -HAEN for high amp enable or -LAEN for low amp enable. Specify -FL for flange	\$ 295	\$ 195
ICM-2900-OPT0	ICM with optoisolated outputs	\$ 345	\$ 245
ICM-2908	Interconnect module for auxiliary encoders	\$ 125	\$ 95
TERM-H	Hand-held terminal	\$ 595	\$ 415
TERM-P	Panel-mount terminal	\$ 945	\$ 765
Cable-USB-2M	USB cable, 2 meter	\$ 10	\$ 10
Cable-USB-3M	USB cable, 3 meter	\$ 15	\$ 15
Cable-Ethernet	Ethernet cables	Consult factory	
Cable-9-pin D	RS232 cable	\$ 10	
Cable-100-1M	100-pin high-density cable in 1 meter length	\$ 125	\$ 95
Cable-100-2M	100-pin high-density cable in 2-meter length	\$ 135	\$ 100
Cable-100-4M	100-pin high-density cable in 4 meter length	\$ 150	\$ 105
Cable-36-1M	36-pin high-density cable in 1 meter length	\$ 90	\$ 75
Cable-36-4M	36-pin high-density cable in 4 meter length	\$ 110	\$ 90
Cable-80-1M	80-pin high-density cable in 1 meter length	\$ 125	\$ 95
Cable-80-4M	80-pin high-density cable in 4 meter length	\$ 150	\$ 105
IOM-1964	Input/Output optoisolated module for 64 I/O	\$ 695	\$ 495
Galil Utilities	Communication drivers, SmartTERM, DMCDOS	\$ 20 for CD; free download	
CTOOLKIT	C/C++ documentation and examples	Included with Utilities	
WSDK	Set-up, tuning and analysis software	\$ 195	
ActiveX Tool Kit	Custom ActiveX controls for Visual Basic or Visual C++	\$ 595	

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