

PCI Bus, 1–8 axes

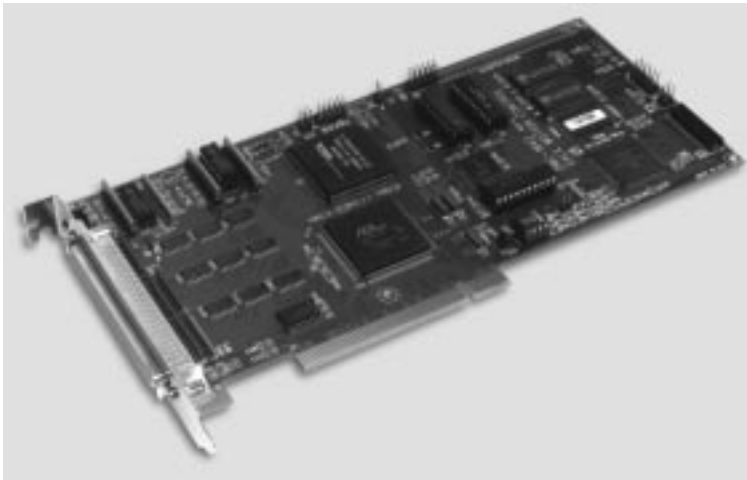
DMC-18x0 and DMC-18x2 Series

Product Description

The DMC-18x0 and DMC-18x2 Series are PCI bus motion controllers designed for multi-axis applications. For single axis PCI applications, Galil's DMC-1417 controller is recommended.

While the DMC-18x0 and DMC-18x2 controllers are both similar in performance, the Econo DMC-18x2 has a few less features that result in a cost-savings. Eliminated features include five through eight axes of control, optical isolation on inputs, uncommitted analog inputs, dual encoder inputs, and only one FIFO communication channel.

DMC-18x2
PCI Bus



Both controllers incorporate a 32-bit microcomputer and provide such advanced features as PID compensation with velocity and acceleration feedforward, memory with multitasking for simultaneously running up to eight programs, and uncommitted I/O for synchronizing motion with external events. Modes of motion include point-to-point positioning, jogging, linear and circular interpolation, contouring, electronic gearing and ECAM.

Like all Galil controllers, the DMC-18x0 and DMC-18x2 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.

Features

- PCI card in 1 through 8 axis versions:
DMC-18x0 where x=1,2,3,4,5,6,7,8 axes
DMC-18x2 where x=1,2,3,4 axes
- User-configurable for stepper or servo motors on any combination of axes. Sinusoidal commutation for brushless servo motors. Optional firmware for piezo-ceramic motors.
- Accepts up to 12 MHz encoder frequencies for servos. Outputs up to 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 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 limits accepted for every axis. Optical isolation on the DMC-18x0 only
- 8 Uncommitted inputs and 8 outputs for 1- through 4-axis models, 24 inputs and 16 outputs for 5- through 8-axis models. Optical isolation on the DMC-18x0 only
- High speed position latch and output compare for each axis
- 8 uncommitted analog inputs for the DMC-18x0 only
- Dual encoder inputs for the DMC-18x0 only
- Expansion for 64 I/O with optional DB-14064 board
- 100-pin SCSI connectors for each set of 4 axes. Galil's ICM-2900 interconnect module breaks-out 100-pin cable into screw terminals
- Communication drivers for all current versions of Windows, DOS and Linux
- CE certified
- Custom hardware and firmware options available

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DMC-18x0 and DMC-18x2 Series

Specifications

System Processor

- Motorola 32-bit microcomputer

Communications Interface

- DMC-18x0: PCI with bi-directional FIFO plus auxiliary FIFO
- DMC-18x2: PCI with bi-directional FIFO

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 (DMC-18x0 only)
- 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	ANALOG INPUTS
DMC-1810 thru -1840	8	8	8
DMC-1850 thru -1880	24	16	8
DMC-18x2	8	8	0

High Speed Position Latch

- Uncommitted inputs 1–8 latch X,Y,Z,W,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)
- Dual encoder (for axes configured as servo)—Channel A, A-, B, B- (for DMC-18x0 only)
- Forward and reverse limit inputs—optoisolated on DMC-18x0
- Home input—optoisolated on DMC-18x0
- 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 (per card)
- High-speed position compare output (per card)

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-18x0:	DMC-18x2:
+5V	750mA	750mA
-12V	40mA	20mA
+12V	40mA	20mA

Environmental

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

Mechanical

- DMC-18x0: 1–4 axes: 11.15" $\times$ 4.8"
5–8 axes: 12.3" $\times$ 4.8"
- DMC-18x2: 9" $\times$ 4.23"

PCI Bus, 1–8 axes

DMC-18x0 and DMC-18x2 Series

Instruction Set

Servo Motor

AF	Analog feedback
DV	Dual loop operation
FA	Acceleration feedforward
FV	Velocity feedforward
IL	Integrator limit
IT	Independent time constant
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
CB	Clear bit
CO	Configure I/O points
II	Input interrupt
OB	Define output bit
OC	Output compare function
OP	Output port
SB	Set bit
UI	User interrupts

System Configuration

BN	Burn parameters
BP	Burn program
BV	Burn variables and arrays
CE	Configure encoder type
CN	Configure switches
CO	Configure I/O points
CW	Data adjustment bit
DE	Define dual encoder position
DP	Define position
DR	DMA / FIFO update rate
DV	Dual velocity (dual loop)
EI	Enable interrupts
EO	Echo off
IT	Independent smoothing
LZ	Leading zeros format
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
TB	Tell status

Interrogation (cont.)

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
UI	User interrupt
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

PCI Bus, 1–8 axes

DMC-18x0 and DMC-18x2 Series

Connectors

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

Axis 1–4 DMC-18x0 and DMC-18x2

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

*(NC for 18x2)

Axis 5–8 DMC-18x0

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 Input 17
42 I- G	92 Input 18
43 A+ H	93 Input 19
44 A- H	94 Input 20
45 B+ H	95 Input 21
46 B- H	96 Input 22
47 I+ H	97 Input 23
48 I- H	98 Input 24
49 +12 V	99 -12 V
50 +12 V	100 -12 V

Auxiliary Encoder (Axis 1–4) DMC 18x0 only

26-pin IDC

1 5 V	2 Ground
3 +aa X	4 -aa X
5 +ab X	6 -ab X
7 +aa Y	8 -aa Y
9 +ab Y	10 -ab Y
11 +5 V	12 Ground
13 +aa Z	14 -aa Z
15 +ab Z	16 -ab Z
17 +aa W	18 -aa W
19 +ab W	20 -ab W
21 Sample clock	22 NC
23 NC	24 NC
25 NC	26 NC

Auxiliary Encoder (Axis 5–8) DMC 18x0 only

26-pin IDC

1 5 V	2 Ground
3 +aa E	4 -aa E
5 +ab E	6 -ab E
7 +aa F	8 -aa F
9 +ab F	10 -ab F
11 +5 V	12 Ground
13 +aa G	14 -aa G
15 +ab G	16 -ab G
17 +aa H	18 -aa H
19 +ab H	20 -ab H
21 Sample clock	22 NC
23 NC	24 NC
25 NC	26 NC

PCI Bus, 1–8 axes

DMC-18x0 and DMC-18x2 Series

Hardware Accessories

ICM-1900 Interconnect Module

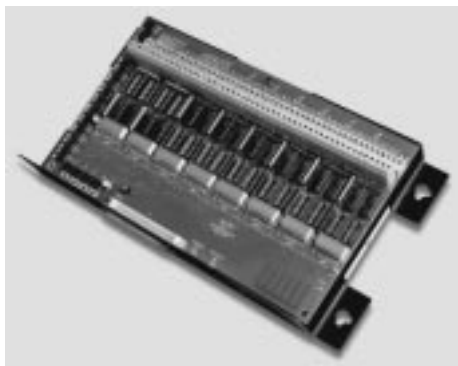
The ICM-1900 Interconnect Module breaks-out the 100-pin main cable and 25-pin auxiliary encoder cable into screw-type terminals for quick connection of system hardware. An ICM-1900 is required for each set of four axes. The ICM-1900 is contained in a metal enclosure with dimensions of 13.5" × 2.675" × 6.88" and 1/4" diameter keyholes for mounting. The ICM is normally shipped configured for high amp enable (-HAEN). For low amp enable, order ICM-1900-LAEN. Also specify -OPTO for optoisolated outputs. If using auxiliary encoders with the DMC-18x0, use a CABLE-26-25 26-pin to 25-pin converter to the ICM-1900.



*ICM-1900 Interconnect Module
and AMP-1900 Series*

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 DB-14064. 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".



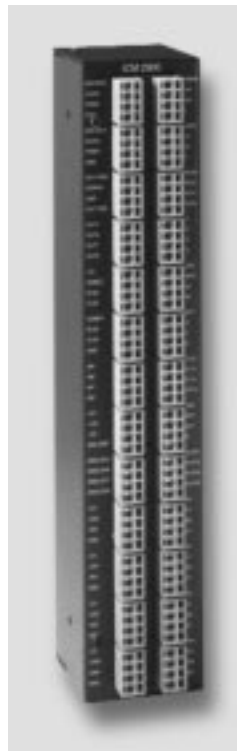
*IOM-1964 Optically Isolated 64-bit
Input/Output Module*

AMP-19x0 Interconnect Module with Amplifiers

The AMP-19x0 series is an ICM module above with 1 to 4 PWM amplifiers for brush-type servo motors. Each amplifier provides 6 amps continuous, 10 amps peak at up to 80 Volts. The gain of the amplifier is 1 A/V and requires an external DC supply from 20 to 80 Volts. The minimum motor inductance is 1 mH and the PWM frequency is 30 kHz.

ICM-2900 Interconnect Module

The ICM-2900 breaks-out the 100-pin SCSI cable into screw-type terminals. One ICM-2900 is required for each set of four axes. The ICM-2900-FL has flanges which allow standard screw-type mounting for card-level Optima controllers. Specify -OPTO for optoisolated outputs. Specify -HAEN for high amp enable and -LAEN for low amp enable.



*ICM-2900 Interconnect Module
(shown without flange)*

DB-14064 I/O Expansion

The DB-14064 is an optional board which provides 64 additional I/O for the DMC-18x0 and DMC-18x2 controllers. 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. A CB-50-80 adaptor can be used to convert the IDC connectors to an 80-pin connector. Using the adaptor and the Cable-80 allows for direct connection to the Galil IOM-1964 opto-isolation module.

PCI Bus, 1–8 axes

DMC-18x0 and DMC-18x2 Series

Ordering Information

PART NUMBER	DESCRIPTION	QUANTITY 1	QUANTITY 100
DMC-1810	1-axis Optima, PCI	\$1095	\$ 795
DMC-1820	2-axis Optima, PCI	\$1495	\$ 875
DMC-1830	3-axis Optima, PCI	\$1895	\$ 935
DMC-1840	4-axis Optima, PCI	\$2195	\$ 995
DMC-1850	5-axis Optima, PCI	\$2595	\$1345
DMC-1860	6-axis Optima, PCI	\$2795	\$1425
DMC-1870	7-axis Optima, PCI	\$2995	\$1525
DMC-1880	8-axis Optima, PCI	\$3195	\$1595
DMC-1812	1-axis Econo PCI	\$ 795	\$ 595
DMC-1822	2-axis Econo PCI	\$ 895	\$ 665
DMC-1832	3-axis Econo PCI	\$1045	\$ 725
DMC-1842	4-axis Econo PCI	\$1195	\$ 795
CB-50-100-1880	50- to 100-pin converter board; incl. two ribbon cables for DMC-1850 to -1880	\$ 75	\$ 50
CABLE-26-25	26-pin IDC to 25-pin D type for auxiliary encoders	\$ 15	\$ 15
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
ICM-1900	Interconnect module (use 1 for every 4 axes). Specify -HAEN for high amp enable or -LAEN for low amp enable	\$ 345	\$ 245
ICM-1900-OPTO	ICM with optoisolated outputs	\$ 395	\$ 295
ICM-2900-FL	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-OPTO	ICM with optoisolated outputs	\$ 345	\$ 245
DB-14064	Attachment board for 64 additional I/O for DMC-18x0, DMC-18x2	\$ 395	\$ 245
CB-50-80	50-pin to 80-pin adaptor for DB-14064	\$ 75	\$ 50
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.