

PCI Bus Accelera Series, 1–8 axes

DMC-18x6 Series

Product Description

The DMC-18x6 PCI bus motor controllers belong to Galil's latest generation motion controller family: the Accelera Series. Incorporating a 32-bit RISC-based microcomputer, these controllers offer high-speed performance and processing power. Speed improvements include acceptance of encoder inputs up to 22 MHz, servo update rates as low as 31 microseconds/axis, and command execution times as low as 40 microseconds. While the DMC-18x6 offers performance enhancements compared to prior generation PCI controllers, the programming language and 100-pin SCSI connector are virtually the same, making conversion to the DMC-18x6 quick and easy.

The DMC-18x6 is available in one through eight-axis formats, and each axis is user-configurable for stepper or servo motor operation. The controller includes optically isolated inputs including a forward limit, reverse limit and home input for each axis, in addition to uncommitted analog and digital I/O. Up to two encoders are accepted for each servo axis.

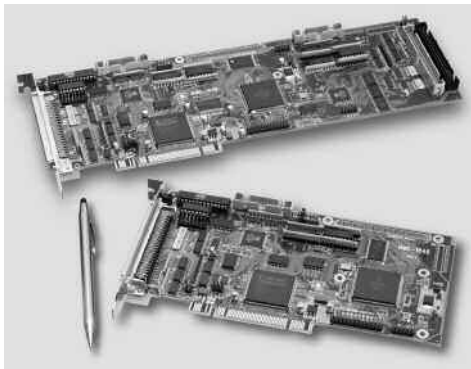
Standard programming features include PID compensation with velocity and acceleration feedforward, multitasking for simultaneously running up to eight programs, and I/O processing commands for synchronizing motion with external events. Modes of motion include point-to-point positioning, position tracking, jogging, linear and circular interpolation, contouring, PVT, electronic gearing and ECAM. Like all Galil controllers, the DMC-18x6 controllers use Galil's popular, intuitive command language which makes them very easy to program. The new GalilTools software further simplifies system set-up with "one-button" servo tuning and real-time display of position and velocity information.

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Features

- *PCI card in 1 through 8 axis versions: DMC-18x6 where x=1,2,3,4,5,6,7,8 axes*
- *User-configurable for stepper or servo motors on any combination of axes. Optional firmware for piezo-ceramic motors. Configurable for sinusoidal commutation*
- *Accepts up to 22 MHz encoder frequencies for servos. Outputs up to 6 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, PVT, linear and circular interpolation, electronic gearing and electronic cam. Features elliptical 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*
- *Optically isolated home input and forward and reverse end-of-travel limits accepted for every axis.*
- *1- through 4-axis: 8 isolated inputs and 8 outputs
5- through 8-axis: 16 isolated inputs, 16 outputs, 8 digital inputs*
- *High speed position latch for each axis and output compare*
- *8 uncommitted analog inputs*
- *Dual encoder inputs for each servo axis*
- *Expansion for 64 I/O with optional DB-14064 board*
- *100-pin SCSI connectors for each set of 4 axes. ICM-2900 or ICM-1900 breaks-out 100-pin cable into screw terminals*
- *AMP-19540 connects to PCI controller with 100-pin cable and provides four amplifiers for 500 W servos*
- *Communication drivers for Windows, Mac OSX, and Linux*
- *Custom hardware and firmware options available*

DMC-1886
and DMC-1846



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Specifications

System Processor

- RISC-based, clock multiplying processor with DSP functions

Communications Interface

- PCI with bi-directional FIFO and Dual Port RAM
- 32-bit PCI interface. 64-bit compatible. 5 V/3.3 V

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

Modes of Motion:

- Point-to-point positioning
- Position Tracking
- Jogging
- 2D Linear and Circular Interpolation with feedrate override
- Linear Interpolation for up to 8 axes
- Tangential Following
- Helical
- Electronic Gearing with multiple masters and ramp-to-gearing
- Gantry Mode
- Electronic Cam
- Contouring
- PVT (Position-Velocity-Time)
- Teach and playback

Memory

- Program memory size — 2000 lines × 80 characters
- 510 variables
- 16,000 total array elements in up to 30 arrays

Filter

- PID with velocity and acceleration feedforward
- Notch filter and low-pass filter
- Dual-loop control for backlash compensation
- Velocity smoothing to minimize jerk
- Integration limit
- Torque limit
- Offset adjustment

Kinematic Ranges

- Position: 32 bit (± 2.15 billion counts per move; automatic rollover; no limit in jog or vector modes)
- Velocity: Up to 22 million counts/sec for servo motors
- Acceleration: Up to 1 billion counts/sec²

Uncommitted Digital I/O

	DIGITAL INPUTS	DIGITAL OUTPUTS	ANALOG INPUTS
DMC-1816 thru -1846	8	8	8
DMC-1856 thru -1886	24	16	8

High Speed Position Latch

- Uncommitted inputs 1–4 latch X,Y,Z,W and 9–12 latch E, F, G, H axes (latches 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-
- Forward and reverse limit inputs — optoisolated
- Home input — optoisolated
- Selectable high-speed position latch input — optoisolated
- Selectable abort input for each axis — optoisolated

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 (one per controller)
- High-speed position compare output (1 per set of 4 axes)

Minimum Servo Loop Update Time

	STANDARD	-FAST [†]
■ 1–2 axes:	62 μ sec	31 μ sec
■ 3–4 axes:	125 μ sec	62 μ sec
■ 5–6 axes:	156 μ sec	94 μ sec
■ 7–8 axes:	187 μ sec	125 μ sec

Maximum Encoder Feedback Rate

- 22 MHz

Maximum Stepper Rate

- 6 MHz (Full, half or microstep)

Power Requirements

- DMC-18x6: +5V 700 mA
- +3.3V 600 mA
- +12V 150 mA
- -12V 40 mA

Environmental

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

Mechanical

- DMC-18x6: 1–4 axes: 7.850" × 4.2"
5–8 axes: 12.28" × 4.2"

Connectors

- 100-pin HD SCSI for axes 1–4 and 5–8
CB-50-100-18X6 required for 5–8 axes. (Occupies two PCI bays, one PCI slot)

[†]Reduced feature set for -FAST.

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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
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

Internal Sine Commutation

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
AQ	Analog configuration
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
@AN[x]	Value of analog input x
@IN[x]	State of digital input x
@OUT[x]	State of digital output x

System Configuration

BN	Burn parameters
BP	Burn program
BV	Burn variables and arrays
CE	Configure encoder type
CN	Configure switches
CW	Data adjustment bit
DE	Define dual encoder position
DP	Define position
DR	DPRAM update rate
EI	Enable interrupts
EO	Echo
IT	Independent smoothing
^L^K	Program protect (Lock)
LZ	Leading zeros format
MO	Motor off
MT	Motor type
PF	Position format
PW	Password
QD	Download array
RS	Reset
^R^S	Master reset
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
%	Modulus operator

Interrogation

LA	List arrays
LL	List labels
LS	List program
LV	List variables
MG	Message command
QR	Return data record
QU	Upload array
QZ	Return data record info
RL	Report latch
RP	Report command position
^R^V	Firmware revision information
SC	Stop code
TB	Tell status
TC	Tell error code
TD	Tell dual encoder
TE	Tell error
TI	Tell input
TP	Tell position

Interrogation (cont.)

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

Programming

BK	Break point
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
RD	Record data
RE	Return from error routine
REM	Remark program
RI	Return from interrupt routine
SL	Single step
UI	User interrupt
UL	Upload program
XQ	Execute program
ZA	Data record variables
ZS	Zero stack
'	Comment

Error Control

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

PV	Position, velocity, time
BT	Coordinate start

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

Vector/Linear Interpolation

CA	Define vector plane
CR	Circular interpolation move
CS	Clear motion sequence
ES	Elliptical scaling
IT	Smoothing time constant
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
VV	Vector Velocity

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ACCELERA

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

Axis 1–4 DMC-18x6

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

Axis 5–8 DMC-18x6

1 NC	51 NC
2 Ground	52 Ground
3 5V	53 5V
4 Error output*	54 Limit common
5 Reset*	55 Home H
6 Encoder–output compare E–H	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 5V
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 Reserved
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 5V
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 +12V	99 -12V
50 +12V	100 -12V

Auxiliary Encoder (Axis 1–4)

26-pin IDC

1 5V	2 Ground
3 AA+A	4 AA-A
5 AB+A	6 AB-A
7 AA+B	8 AA-B
9 AB+B	10 AB-B
11 +5V	12 Ground
13 AA+C	14 AA-C
15 AB+C	16 AB-C
17 AA+D	18 AA-D
19 AB+D	20 AB-D
21 Sample clock	22 NC
23 NC	24 NC
25 NC	26 NC

Auxiliary Encoder (Axis 5–8)

26-pin IDC

1 5V	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 +5V	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

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Connectors—AMP-19540 Interconnect with four 500 W servo drives

J1 Power 8-pin AMP Mate-n-lock II

- 1 Earth
- 2 +VM (18 V–80 V)
- 3 +VM (18 V–80 V)
- 4 +VM (18 V–80 V)
- 5 Ground
- 6 Ground
- 7 Ground
- 8 Ground

JX1, JY1, JZ1, JW1 Motor Output 4-pin AMP Mate-n-lock II

- 1 Earth
- 2 Motor phase A
- 3 Motor phase B
- 4 Motor phase C

J3 I/O 44-pin Hi-density Female D-sub

- 1 PWM/MCMD Z
- 2 Output 6
- 3 Output 8
- 4 Output 5
- 5 Output 2
- 6 Abort*
- 7 Input 6
- 8 Latch C/Input 3
- 9 SIGN/AEN B
- 10 Encoder compare output
- 11 Reverse limit A
- 12 Reverse limit B
- 13 Reverse limit C
- 14 Reverse limit D
- 15 Forward limit D
- 16 SIGN/AEN D
- 17 SIGN/AEN C
- 18 Output 7
- 19 Output 4
- 20 Output 1
- 21 Output 3
- 22 Input 7
- 23 Latch D/Input 4
- 24 Latch A/Input 1
- 25 PWM/MCMD A
- 26 Home A
- 27 Home B
- 28 Home C
- 29 Home D
- 30 Error Output*/INCOM
- 31 PWM/MCMD D
- 32 5 V
- 33 5 V
- 34 Ground
- 35 Ground
- 36 Input 8
- 37 Input 5
- 38 Latch B/Input 2
- 39 PWM/MCMD B
- 40 SIGN/AEN A
- 41 Forward limit A
- 42 Forward limit B
- 43 Forward limit C
- 44 Reset*/LSCOM

J4 X-axis 15-pin Hi-density Female D-sub

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

J5 Y-axis 15-pin Hi-density Female D-sub

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

J6 Z-axis 15-pin Hi-density Female D-sub

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

J7 W-axis 15-pin Hi-density Female D-sub

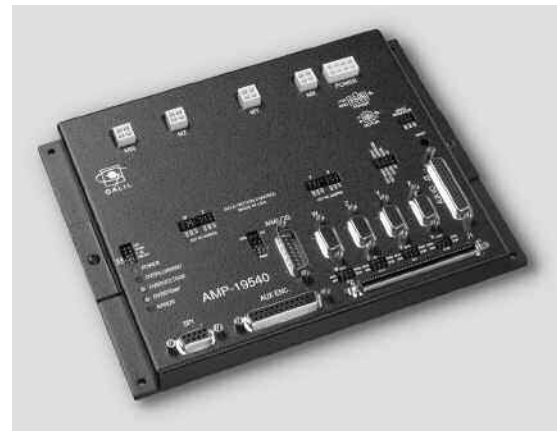
- 1 I+ D
- 2 B+ D
- 3 A+ D
- 4 AB+ D
- 5 Ground
- 6 I- D
- 7 B- D
- 8 A- D
- 9 AA- D
- 10 Hall A D
- 11 AA+ D
- 12 AB- D
- 13 Hall B D
- 14 Hall C D
- 15 5 V

J11 SPI 9-pin Female D-sub (reserved)

J12 Analog 15-pin Male D-sub

- 1 Analog ground
- 2 Analog input 1
- 3 Analog input 3
- 4 Analog input 5
- 5 Analog input 7
- 6 Analog ground
- 7 -12 V
- 8 5 V
- 9 Analog ground
- 10 Analog input 2
- 11 Analog input 4
- 12 Analog input 6
- 13 Analog input 8
- 14 Analog ground
- 15 +12 V

AMP-19540



*Active low

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DMC-18x6 Series

Ordering Information

PART NUMBER	DESCRIPTION	QUANTITY 1	QUANTITY 100
DMC-1816	1-axis Accelera, PCI	\$1095	\$ 795
DMC-1826	2-axis Accelera, PCI	\$1495	\$ 875
DMC-1836	3-axis Accelera, PCI	\$1895	\$ 935
DMC-1846	4-axis Accelera, PCI	\$2195	\$ 995
DMC-1856	5-axis Accelera, PCI	\$2595	\$1345
DMC-1866	6-axis Accelera, PCI	\$2795	\$1425
DMC-1876	7-axis Accelera, PCI	\$2995	\$1525
DMC-1886	8-axis Accelera, PCI	\$3195	\$1595
CB-50-100-1886	50- to 100-pin converter board; incl. two ribbon cables for DMC-1856 to -1886	\$ 75	\$ 50
CABLE-100-1M	100-pin HD cable in 1 meter length	\$ 165	\$ 125
CABLE-100-2M	100-pin HD cable in 2-meter length	\$ 180	\$ 135
CABLE-100-4M	100-pin HD cable in 4 meter length	\$ 195	\$ 145
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
AMP-19520	2-axis amplifier for 500 W servo motors	\$ 595	\$ 395
AMP-19540	4-axis amplifier for 500 W servo motors	\$ 795	\$ 495
-SR	Shunt regulator option for AMP-195x0	\$ 50	\$ 25
DB-28104	Sinusoidal Encoder Interpolation Board	\$ 395	\$ 245
DB-14064	Attachment board for 64 additional I/O	\$ 295	\$ 195
CB-50-80	50-pin to 80-pin adaptor for DB-14064	\$ 75	\$ 50
CB-36-25	36-pin adaptor for aux encoders using ICM-2908	\$ 50	\$ 45
CABLE-36-1M	36-pin HD cable for aux encoders using ICM-2908	\$ 90	\$ 75
ICM-2908	Aux encoder breakout	\$ 125	\$ 95
CABLE-26-25	Ribbon cable for aux encoders with ICM-1900 or AMP-19540	\$ 15	\$ 15
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	
ActiveX Tool Kit	Custom ActiveX controls for Microsoft platforms	\$ 595	

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