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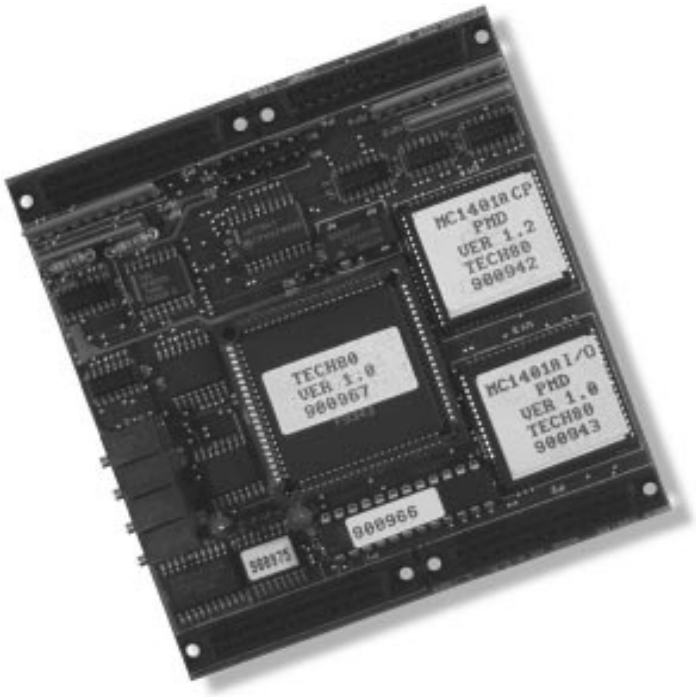
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Find the *ACS Motion Control / Tech80 50A* at our website: ***Click HERE***

The People in Control of Motion™



Model 50A 1-4 Axes IndustryPack® Servo Motion Controller

PMD DSP Motion Control Chipset

PID with Velocity Feedforward Servo Control Loops

S-Curve, Trapezoidal & Velocity Motion Profiles

Open Architecture Software Library For C, C++, BASIC, Pascal, Visual Basic, Windows™ DLLs

16-Bit Analog (DAC) or 10-Bit PWM Command Signal Output

1.0 MHz Incremental Quadrature Encoder Input

Electronic Gearing Capabilities

The Model 50A offers power and remarkable design flexibility to even the most challenging motion control applications. With its double-wide IndustryPack (IP) configuration, the 50A provides four axes of DSP-based, servo motion control.

The 50A was created with a commitment to Tech 80's open architecture design philosophy. With its industry-standard language support, programming is far easier than proprietary languages, and throughput isn't slowed by lengthy ASCII transfers. Motion-specific function calls enhance standard languages, which enable ease of programming.

Its PMD's 1401A DSP chipset is the heart of the Model 50A. The chipset handles the servo algorithms with PID and velocity feedforward filtering for all four axes. It performs the intensive computational tasks required for high performance applications such as digital velocity, torque and position control.

The 50A is part of Tech 80's Modular Motion System™, a flexible multi-architecture (IP, PC, PC/104, VME) family of expansion modules and carrier boards that are designed for communications, industrial I/O, motion control, networking and many other applications. Supported by a number of key industry leaders, Tech 80's Modular Motion System offers designers flexible and powerful solutions to meet their systems' demands.

Modular Motion System™

Affordable & Precise Multi-Axis Motion Control

Features

The Model 50A is ideally suited for PC-based OEM applications such as embedded machine control, packaging and semiconductor processing. The 50A has the power and flexibility demanded bu many applications.

IndustryPack (IP) Design Flexibility

The IP form-factor has quickly become a leading expansion architecture due to its compact, flexible design and its acceptance by industry leaders such as Motorola. In addition to the 50A, Tech 80 provides a number of other IP modules and carrier boards for encoder interfacing, industrial I/O, servo and step motion control. From avionics to networking to video control, the 50A is easily incorporated with a wide variety of third-party vendor IP modules.

DAC & PWM Output Supported

The 50A can control each axis independently or synchronously. It outputs either analog (16-Bit DAC) or PWM command signals and provides for acceleration, position, velocity and jerk profile control.

Electronic Gearing Capabilities

Gearing allows for tight coordination between axes without taking up host processing time. The host specifies one parameter — the gear ratio. The target position for the slaved axis is generated by applying that ratio to the current position of the master axis and thus slaving the driven axis to the master encoder or axis.

Application Success Story: Automated Warehouse

Opportunity:

A factory customer designs large storage and retrieval systems for major manufacturers. These systems are designed to act as automated warehouses, capable of storing and recalling inventory on demand. These systems move materials within a single building, between buildings, and even between manufacturing facilities. This customer could not achieve the desired information & control throughput with the host computer alone. In addition, to achieve position accuracy, the customer needed the capability of laser positioning for the purpose of developing an error compensation table to correct for position error accumulation.

Analysis:

Inventory control, operator interface, report generation, and communication kept the host computer so busy that it could not control the storage and retrieval servos at the desired speed. This customer builds large systems that can contain over 24 axes of servo motion, and this does not include the other general conveyor mechanisms, elevators, operator input/output stations, switch tracks, or bar code readers.

The customer wanted to incorporate S-Curve motion profiling to reduce the system wear typically caused by trapezoidal moves. They also needed a dedicated CPU to handle all the direct servo control while having the host computer handle all the rest. On the dedicated CPU, dual position feedback was necessary — one for the encoder and one for the Laser.

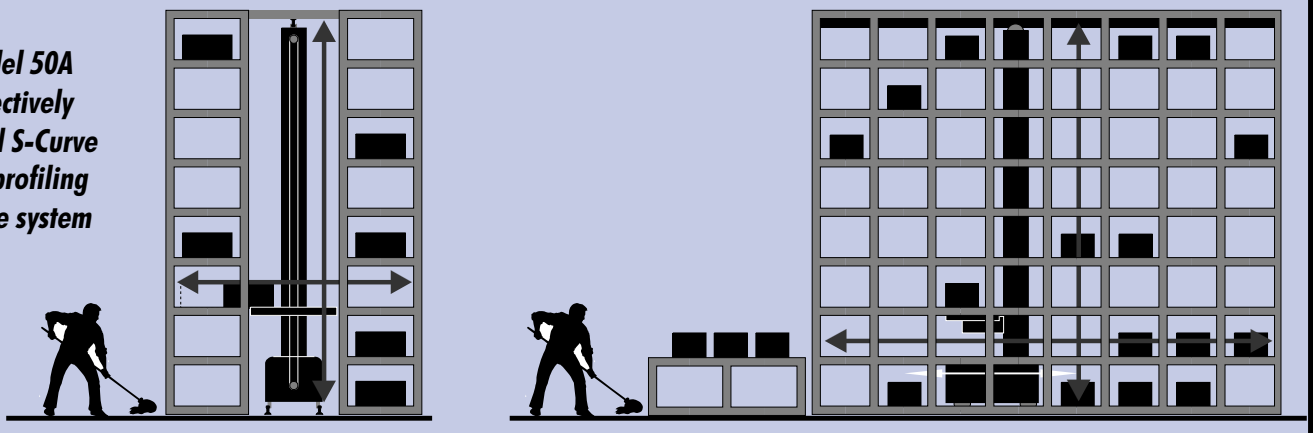
Solution:

The customer considered two other boards for this application, but neither one offered the features needed. We recommended a Model 50A DSP Servo Controller with the Model 5643 Intelligent IndustryPack Carrier Board. Unlike Tech 80's solution, neither board could access all on-board hardware ports without buying unnecessary options.

As part of the Modular Motion System™, the Models 50A and 5643 offered a simple, remarkably flexible solution. Their modularity allowed the needed hardware serial ports to be added for the laser and other I/O by way of mezzanine card expansion. Also, it could off load all motion decision-making processes from the host CPU and allow the host CPU to handle only the system overhead. The customer could also spend time and effort more wisely, writing more efficient software to allow the system to maintain its product throughput design goals.

These two features alone — binary language transfer and access to all on-board hardware ports — met all the customer's needs and easily fit within their budget.

The Model 50A cost-effectively provided S-Curve motion profiling to reduce system wear.



Tech 80 provides software drivers in BASIC, C, assembly language and Pascal. The dynamic linkable libraries (DLL's) may be called from a variety of languages. Interrupt support is included.

Along with example code and templates, Tech 80 provides a number of software tools for developing applications with the Model 50A. A checkout program is useful for initial control configuration and test. With Intellitune™, servo motor tuning with the 50A is dramatically easier. The Modular Motion Toolkit™ offers a Windows-based interface to quickly incorporate the 50A onto Tech 80's PC carrier boards.

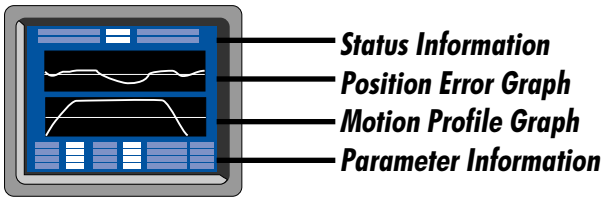
Tune Servo Motors Easily

With Tech 80's Intellitune software, tuning servo motors is no longer a time-consuming, difficult process. The program verifies factors such as motor resolution, amplifier operating mode and best acceleration to determine systems values and filter adjustments for tuning. Intellitune processes these values and uses them to help you tune the servo motors easily.

Adjust & View System Functions In Windows

The Modular Motion Toolkit includes graphical interfaces that help you access and edit parameters associated with Model 50A motion functions. A tuning display screen is included, eliminating the need for an oscilloscope. System response is graphically presented. The digital filter parameters (PID VFF) are adjustable and the results can be instantly viewed.

Optimized parameters may be saved and used in the actual application program. System configurations for multiple axes and boards are stored for future use.



Checkout provides users all information in this easy-to-read GUI.

A programmable error limit generates an interrupt when an excessive difference between actual and commanded position occurs. S-Curve and trapezoidal motion profiles are supported.

50A Example Code: 4-Axes Motion Control

This pseudo-code offers two examples of programming with the Model 50A. The first example demonstrates moves with a four-axis robotic arm application. The second is an example of a changing the velocity at a given distance from the start. For more detailed example code please refer to *Programming With Tech 80 Products*.

Example #1:

Initialize the 50A servo controller board

```
printf ("Version = %x \r\n", te50InitSw());
if (te50InitServo(B_ADDR, TE50TYPE_DAC16) != 0)
{printf("Board not responding\n"); return(0);}
```

Set axis

```
te50SetAxisMask(Board_Num, TE50AXIS_ALL);
```

Load the axis filter parameters

```
te50FilterPIDVFF(KP, KI,KD,KV, KVFF, IL);
te50Update();
te50SetAxis(Board_Num, AxisX);          Point to the X axis
te50ProfileTrap(PosX, VelX, AcelX);     Load the X Profile
te50SetAxis(Board_Num, AxisY);          Point to the Y axis
te50ProfileTrap(PosY, VelY, AcelY);     Load the Y Profile
te50SetAxis(Board_Num, AxisZ);          Point to the Z axis
te50ProfileTrap(PosX, VelZ, AcelZ);     Load the Z Profile
te50SetAxis(Board_Num, AxisW);          Point to the W axis
te50ProfileTrap(PosY, VelW, AcelW);     Load the W Profile
```

Set axis

```
te50SetAxisMask(Board_Num, TE50AXIS_ALL);
te50Update();                           Start move
te50SetAxis(Board_Num, AxisX);          Point to the X axis
while (!te50IsComplete());              Wait for axis done
```

Example #2:

Initialize the 50A servo controller board

```
printf ("Version = %x \r\n", te50InitSw());
if (te50InitServo(B_ADDR, TE50TYPE_DAC16) != 0)
{printf("Board not responding\n"); return(0);}
```

Set axis

```
te50SetAxis(Board_Num, TE50AXIS_1);
```

Load the axis filter parameters

```
te50FilterPIDVFF(KP, KI, KD, KV, KVFF, IL);
te50Update();
te50ProfileTrap (PosX, VelX, AcelX);
te50Update();                           start move
```

Setup to change Velocity at a breakpoint

```
te50SetBreakPoint(dwBrkActlPosn, TE50BRK_AT_GE);
                                        Break actual position greater than
                                          or equal to breakpoint
te50SetVel;                             Load new velocity into buffer
te50AutoUpdateOn();                     Arm automatic update at break-
                                          point event
while(!te50IsBreakpoint())              Loop until breakpoint is reached
```

The 50A software includes all of the following routines. Below is the functional and alphabetical listing of the drivers and constants with a description of each. For more information regarding programming and software, please refer to the *Programming with Technology 80 Products*.

Initializations & Configuration Routines

te50AutoUpdateOff	Turn Breakpoint Automatic Updating Off
te50AutoUpdateOn	Turn Breakpoint Automatic Updating On
te50AxisOff	Turn Axis Off
te50AxisOn	Turn Axis On
te50CaptureHome	Make Capture Trigger the Home Input
te50CaptureIndex	Make Capture Trigger the Index Input
te50DrivesOff	Turn Drive Enable Output Off
te50DrivesOn	Turn Drive Enable Output On
te50FilterPIDVFF	Set PID/VFF Filter Parameters
te50HomePolarity	Set Home Polarity
te50InitServo	Initialize Servo Board
te50InitSw	Initialize Software
te50LimitsOff	Turn Limits Off
te50LimitsOn	Turn Limits On
te50LimitPolarity	Set Limit Polarities
te50MotorOff	Turn Motor Off
te50MotorOn	Turn Motor On
te50PhasesPolarity	Set Phases Polarity
te50PhasesSwapOff	Turn Phase Swapping Off
te50PhasesSwapOn	Turn Phase Swapping On
te50SetAxis	Set Current Board and Current Axis
te50SetAxisMask	Set Current Board and Current Axis Mask
te50SetResolution	Set Resolution
te50SetSampleTime	Set Sample Time

Motion Profile Routines

te50IsComplete	Check Trajectory Complete Event
te50ProfileSCurve	Define S-Curve Profile
te50ProfileTrap	Define Trapezoidal Profile
te50ProfileVel	Define Velocity Profile
te50RelPos	Set Relative Position
te50SetAcc	Set Acceleration
te50SetJerk	Set S-Curve Jerk
te50SetMaxAcc	Set S-Curve Maximum Acceleration
te50SetPos	Set Position
te50SetProfile	Set Profile Type
te50SetRatio	Set Electronic Gearing Ratio
te50SetVel	Set Destination Velocity

Servo Command Routines

te50AxisIsOn	Check Axis On/Off Status
te50BreakPointOff	Turn Breakpoint Off
te50GetMotorBias	Get Motor Bias
te50IsLimit	Check Limit Events
te50IsNegLimit	Check Negative Limit Event
te50IsPosErr	Check Position Error Event
te50IsPosLimit	Check Positive Limit Event
te50Recover	Position Error Recover
te50ResetBoard	Reset Board
te50ResetCapture	Reset Capture Event Flag and Capture Circuitry
te50ResetEvents	Reset Status Event Flags
te50ResetLimits	Reset Limits
te50SendCmd	Send Command to Controller
te50SetActPos	Set Present and Target Positions
te50SetBreakPoint	Set Breakpoint
te50SetExtBrk	Set Break Point to External
te50SetMtnCmplBrk	Set Break at Motion Complete
te50SetMotorLimit	Set Limit for Motor
te50SetMotorBias	Set Motor Bias
te50SetMotor	Set Motor Output
te50SetPosErr	Set Maximum Allowable Position Error
te50SmoothStop	Smoothly Stop the Motor
te50Stop	Abruptly Stop Motor
te50SyncProfile	Zero Position
te50Update	Update Parameters
te50ZeroPos	Zero Position

Data Reporting Routines

te50ActPos	Return Actual Position
te50ActPosError	Return Actual Position Errorr
te50CapturePos	Return Captured Position
te50CurAxis	Get Current Axis

Data Reporting Routines Con't

te50CurAxisMask	Get Current Axis Mask
te50CurBoard	Get Current Board
te50DesPos	Get Current Desired Position
te50DesVel	Get Current Desired Velocity
te50HomeRead	Read Home Input
te50IntrAxis	Return Interrupting Axis
te50IntrBoard	Return Interrupting Board
te50ISum	Return Filter Integration Sum
te50Limits	Return Limit States
te50PhasesRead	Read Phases State
te50Time	Return Current Time

I/O Routines

te50InputsIsHigh	Check Input State
te50InputsRead	Return All Inputs
te50OutputHigh	Set Output High
te50OutputLow	Set Output Low
te50OutputsReadBack	Readback Output Latch
te50OutputsWrite	Write Outputs

Read Back Routines

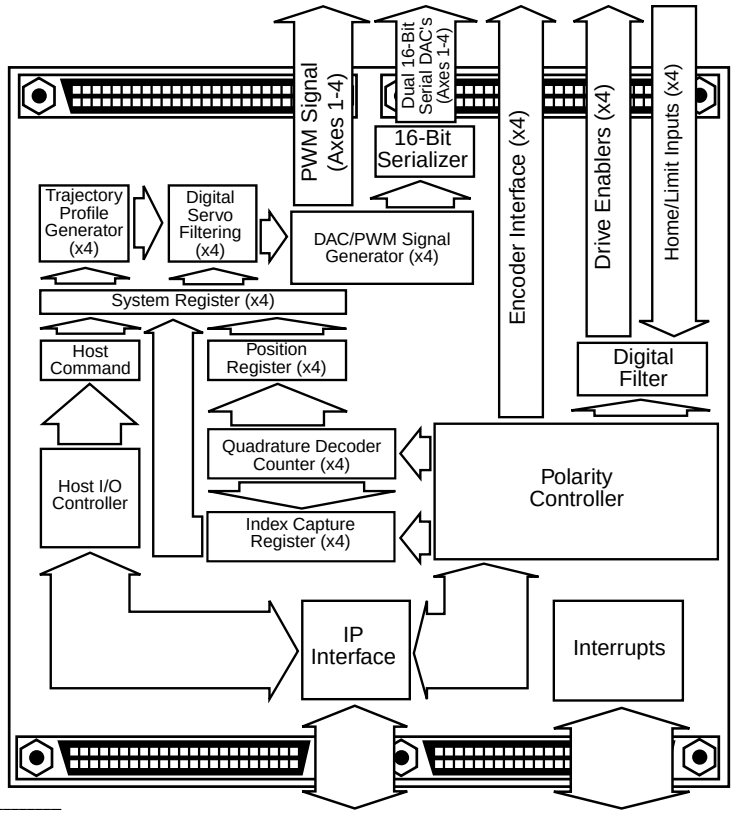
te50GetAcc	Get Last Commanded Acceleration
te50GetBreakPoint	Get Breakpoint
te50GetIntrMask	Get Interrupt Mask
te50GetJerk	Get Last Commanded Jerk
te50GetMaxAcc	Get Last Commanded S-Curve Maximum Accel.
te50GetMode	Get Mode Information
te50GetMotorLimit	Get Last Motor Limit
te50GetMtrCmd	Get Motor Command
te50GetPIDVFF	Get PID/VFF Filter Parameters
te50GetPos	Get Last Commanded Destination Position
te50GetPosErr	Get Maximum Allowable Position Error
te50GetRat	Get Last Commanded Ratio
te50GetSampleTime	Get Sample Time
te50GetVel	Get Last Commanded Destination Velocity
te50IsBreakPoint	Check Breakpoint Event
te50IsCapture	Check Capture Event
te50MotorIsOn	Check Motor On/Off State
te50NotBusy	Check Busy Status
te50ReadIntrs	Read and Reset Interrupt Events
te50RegRead	Read Configuration Register
te50Resolution	Return Resolution
te50SampleTime	Return Last Specified Sample Time
te50Status	Return Status

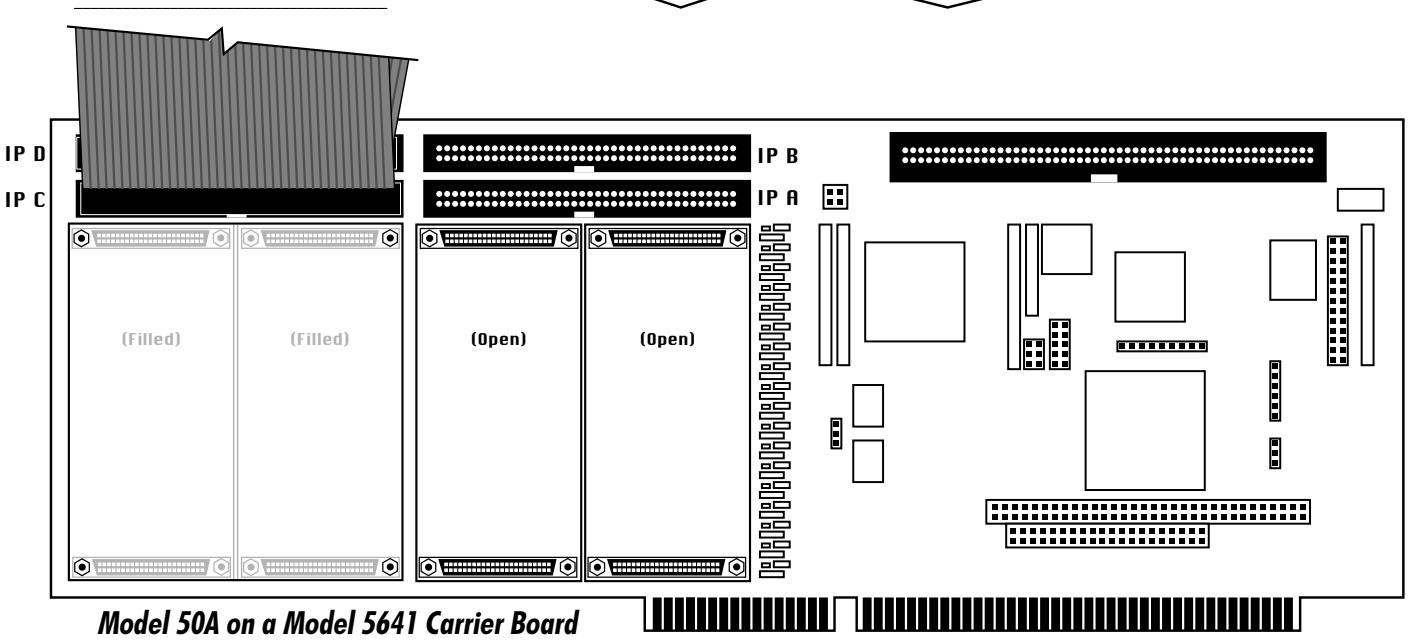
Interrupt Routines

te50DisableIRQ	Disable IRQ Line
te50EnableIRQ	Enable IRQ Line
te50HookIntr	Hook Interrupts
te50IntrIsActive	Check Controller Interrupt State
te50IsWrapAround	Check Wrap-Around Event
te50MaskIntr	Mask Interrupts
te50UnmaskIntr	Unmask Interrupts
te50VelIsZero	Checks if Desired Velocity is Zero

Conversion Routines

te50CvAcc	Get Conversion Constant for Acceleration
te50CvJerk	Get Conversion Constant for Jerk
te50CvPos	Get Conversion Constant for Position
te50CvVel	Get Conversion Constant for Velocity





Model 50A on a Model 5641 Carrier Board

Typical Jumper Configuration

IP Addressing (Default) **300 Hex**

Position	W1	W3	W4	W5	W6
0		Shorted	Shorted	Shorted	Shorted
1	Open				

SPECIFICATIONS

Host Interface:

- IP Compatible Carrier Board
- I/O Mapped Switch-Selectable Address
- 8-Bit Data transfers
- Programmable Interrupts
- High-Speed Binary Communications

Recommended Operating Environment:

- 0 - 70 ° C
- 20 - 95% Relative Humidity, Noncondensing

Servo Loop/Trajectory Update Rate:

- 2.5 KHz Default (4 Axes Enabled)
- 10 KHz Maximum (1 Axis only)
- User-Programmable: 100 µsec. to 3.3 sec.

Servo Output:

- Analog (DAC) @ 16-Bit Resolution
- PWM @ 10-Bit Resolution

Motion Profiles (Axis Independent):

- Velocity
- Gearing
- Trapezoidal
- S-Curve

Controller Chipset:

PMD MC1401A:

- 25 MHz DSP
- Custom ASIC

Position Feedback:

Incremental Quadrature Encoder:
1.0 MHz, Differential or Single-Ended Count Frequency

Motion Ranges:

- Position: ± 1.073 Billion Counts
- Velocity: 0 - 16,384 Counts/Sample Time^2 (Res. 1/65K)
- Acceleration: S-Curve: ± 0.5 Counts/Sample Time^2 (Res. 1/65K)
  All Others: ± 16,384 Counts/Sample Time^2 (Res. 1/65K)
- Jerk: 0 - 0.5 Counts/Sample Time^3 (Res. 1/65K)
  (S-Curve only)

Interrupts (Per Axis):

- Controller Ready
- Time/Position Breakpoints
- Trajectory Complete
- Excess Following Error
- Index/Home Capture

Board Dimensions:

3.6 x 3.9 x 0.6" (9.2 x 10.0 x 1.5 cm)

Power Requirements:

- +5.0 VDC: ± 5% 1.1 Amp
- +12 VDC: ± 10 mA
- -12 VDC: ± 10 mA

Ordering Information

50A	1-4 Axes Servo Motion Controller
50A DEV	Development Kit
50A MAN	Hardware & Software Manuals*
50A SOFT	Demo & Driver Software*

* Included in the Development Kit along with Motor Sizing Software, *Designing with Motion Handbook*, and discount on 9011 Motion Simulator

Warranty

This product is warranted according to the Terms and Conditions of Sale and is effective for ***TWO YEARS AFTER SHIPMENT*** from Technology 80 Inc. For further warranty information, please consult the hardware manual.

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