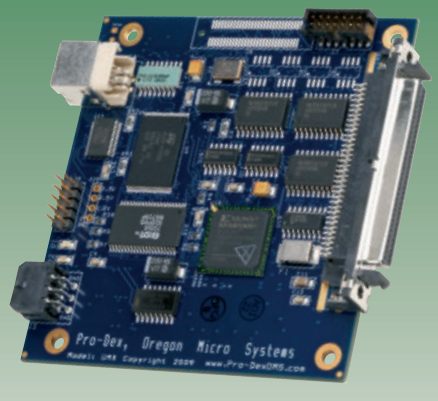
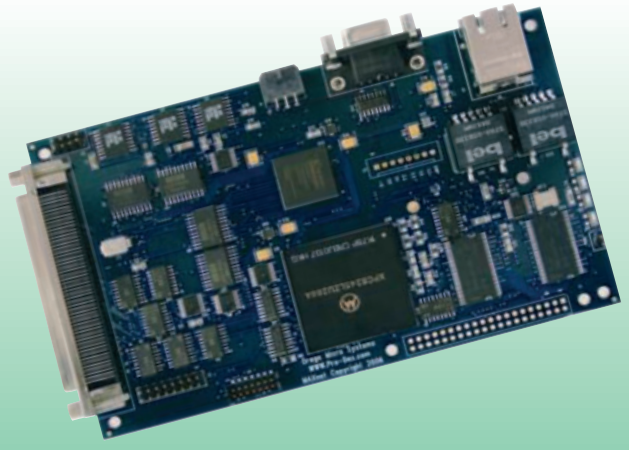
Produkt-Datenblatt, tech. Daten

Pro-Dex OMS Motion-Control



Pro-Dex
Accelerating Possibilities
OREGON MICRO SYSTEMS



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MEILHAUS
ELECTRONIC

MAXnet

Ethernet 5-Axis Motion Controller

FEATURES

Ethernet or RS232 Communications

- Ethernet utilizes standard TCP/IP protocol.
- RS232 Baud rate = 9600 to 115.2K

PID update rate of 122 μs on all 5 axes

- Delivers exceptional servo control on multi-axis applications.
- Identical outcomes when utilizing one or all axes of motion.
- Configurable PID filter with feed forward coefficients.

266 MHz, 32-bit RISC processor

- Updates all signals and data points providing superior application control.

Controller I/O Capabilities

- Each axis has +Limit, -Limit, Home, Auxiliary out, and axis control out.
- 8 General purpose bi-directional TTL I/O
- 1 General purpose analog output with 16 bit, +/-10 VDC input (in addition to axes output).
- 2 Channels of general purpose analog input with 16-bit (+/-10 VDC)

Motion Feedback

- Each axis has an incremental encoder input
- Quadrature Encoder Feed back up to 16 MHz on all encoder inputs.

Sophisticated Control Functionality

- 16 bit DAC analog resolution.
- Step pulses from 0 to 4,194,303 steps per second (+/- 0 steps).
- Backlash compensation.
- Custom, parabolic, “S”-Curve & linear trajectory profiles.
- Real time encoder position capture.
- S-Curve with 4-quadrant jerk parameters.

Control signals

- Single 100-pin SCSI type connector for high density signal connection.
- 8 “user definable” digital I/O.
- Analog out per each axis can be used as general purpose when axis is configured for Step control.

ADDITIONAL FEATURES

- Small form-factor, 4in. x 6.5in.
- Stand-alone capability
- Custom Power-up Defaults
- Non-Volatile Macro Storage
- Patented technology to minimize torque ripple and velocity modulation
- Internal Watchdog timer for safety
- Slip & Stall detection with encoder feedback
- Linear/Circular interpolation
- Constant and variable velocity contouring (all axes)
- Single-axis, multi-axis and multi-tasking modes
- Output is +/-10V, or Step & Direction per Axis
- Independent home and plus / minus over-travel inputs for each axis
- Auxiliary output per axis for Amp/Drive enable
- Commands are intuitive for programming ease.
- Over 250 ASCII character commands, “universal” to current and previous OMS controllers
- Capable of conversion to “user” defined units i.e. inches/ revolutions if desired.
- Designed for expandability (custom solutions)
- Person to person toll-free tech support: 800-707-8111
- OMS has more than 28 years proven success

DESCRIPTION

The MAXnet family of Motion Controllers brings the Oregon Micro Systems, Inc. (OMS) intelligent motion control technology to a new level of servo applications as well as stepping motors. A much more powerful 266 MHz 32 Bit RISC processor (PowerPC) provides the capability and power for better and more sophisticated application control. This newest generation of motion control products provides up to 5 axes of motion control on a single 4 x 6.5 inch card. Each axis can be selected by the user to be an open or closed stepper or a high capability servo axis. In addition, independent analog inputs are provided to enable integration of analog parameters such as velocity override, temperature, pressure, etc., under the control of the running application. An additional general purpose analog output is also available.

Outputs are provided for 16 bit analog servo output as well as step and direction for stepper system applications. The servo loop is a PID filter with feed-forward coefficients and an update rate of 122 μs on all 5 axes. Independent plus and minus limits, a home switch input, and an auxiliary output provided for each of the 5 axes so that the state of any of them can be monitored by the system at any time. An additional 8 User Definable I/O is available for synchronization and control of other events. Incremental encoder feedback, differential or single ended, is used for all servo axes and is available for position feedback and may also be used for slip or stall detection.

PROGRAMMING

The MAXnet motion controllers are easily programmed with character ASCII commands through an extensive command structure. The commands are combined into character strings to create sophisticated motion profiles, with features such as IO and other functionality. A separate FIFO command queue for each axis is used to store the commands once they are parsed in the MAXnet. These commands are then executed sequentially, allowing the host to send a complex command sequence and attend to other tasks, while the MAXnet manages the motion process. These command queues can store 2559 command values and can include a loop counter that allows multiple execution of any command string.

There are approximately 200 commands available. All commands are sent to the controller as two or three character strings. Some of these commands expect one or more numerical operands to follow. These commands are identified with"#" after the command in the description. The "#" indicates a signed integer input parameter, or a signed fixed point number of the format ##.# when User Units are enabled. User Units define distances, Velocity and acceleration parameters, and represent the input in Inches, millimeters, revolution, etc.

Synchronized moves may be made by entering the AA or AM command mode. This form of the command performs a context switch that allows entering commands in the format MRx#,y#,z#,t#,u#;
Numbers are entered for each axis commanded to move. An axis may be skipped by entering a comma {,} at the appropriate axis position with no value parameter. The command may be prematurely terminated with a semicolon (;) i.e. a move requiring only the X and Y axes to move would use the command MRx#,y#; followed by the GO command. Each axis programmed to move will start together upon execution of the GO command. The MAXnet can be switched back to independent-axis mode by entering the desire single axis command, such as AX.

PROGRAMMING EXAMPLES

In a typical move requirement where it is desired to home the stage and then move to a specified position, the following will demonstrate the programming for a single axis:
Initialize the velocity and acceleration parameters to a suitable value. Set the PID filter gain values. Perform the homing operation initializing the position counter to zero. Perform a motion to the absolute position of 10,000 and set the done flag for that axis when the move is finished.

```
AX;
VL5000;
AC50000;
KP20;
KI1;
KD45;
HN;
HM0;
MA10000;
GO;
ID;
```

In a move requiring a three axis coordinated move to a position, the following could be used:

```
AX;
KP2;
KD6;
HN;
AY;
KP2;
KD6;
HN;
AZ;
KP2;
KD6;
HN;
AM;
VL5000,5000,5000;
AC50000,50000,50000;
MA1000,2000,3000;
GO;
ID;
```

The controller would calculate the relative velocities required to perform a straight line move from the current position to the desired position.

SPECIFICATIONS

Velocity

0 to 4,194,303 pulses per second simultaneous on each axis

Acceleration

0 to 8,000,000 pulses per second per second

Position range

± 2,147,487,647

Accuracy

Position accuracy and repeatability ±0 counts for point to point moves

Velocity accuracy ±0.01% of peak velocity in jog mode.

Environmental

Operating temperature range: 0 to 50 degrees centigrade

Storage temperature range: -20 to 85 degrees centigrade

Humidity: 0 to 90% non-condensing

Power

+5VDC +/-5% at 1 amp typical
+12VDC at 0.1 amp typical = +/-5%
-12VDC at 0.1 amp typical = +/-10%

Dimensions

4" x 6.5" x 0.7"

Limit switch inputs

TTL input signals
Active low or high, selectable by command input for each axis (active low is default)

Connector

One shielded 100-Pin SCSI type connector for all signals (motor control, I/O, Limits, etc). Breakout board available for ease of cabling.

Home switch inputs

TTL input signals
Active low or high, selectable by command input for each axis (active low is default)

User definable I/O

Up to 8 bits of user definable digital I/O. The 8 bits are user configurable and are configured as 4 inputs and 4 outputs as defaults from the factory.

Analog inputs

Two independent analog inputs, 16 Bit resolution, +/- 10V.

Analog outputs (servo)

+/-10V and 0 to +10V, max. One per axis plus one general purposes, 16 Bit resolution

Step pulse output

Pulse width 50% duty cycle. Open collector level signal (TTL).

Direction output

Open collector level signal (TTL).

Encoder feedback

Maximum 16 MHz after 4x quadrature detection. Differential signal.

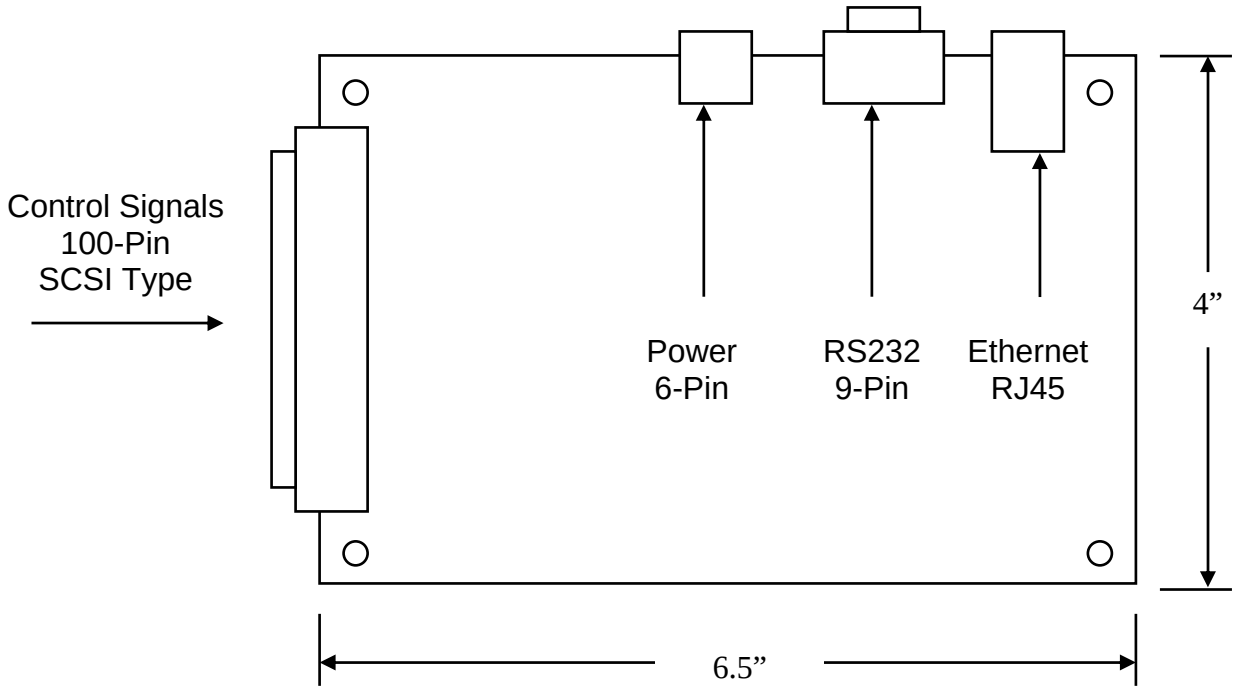
Reference

IEEE 802

Software

Software interface utilities provided.
High level expertise not required.
Over 250 ASCII character commands, expanded from current OMS command set while backwards compatible.

"The Company in Motion"



Ordering Information	
Model	No. of Axes
MAXnet-1000	1
MAXnet-2000	2
MAXnet-3000	3
MAXnet-4000	4
MAXnet-5000	5

ACCESSORIES	
IOMAXnet	I/O Breakout Board for MAXnet
CBL58-3M	I/O cable for MAXnet to IOvMAX, 3 meters

3701-1800000
Revision B

MAXnet w/DBnet

Ethernet 10-Axis Motion Controller

FEATURES

Ethernet or RS232 Communications

- Ethernet utilizes standard TCP/IP protocol.
- RS232 Baud rate = 9600 to 115.2K

PID update rate of 122 μs on all 10 axes

- Delivers exceptional servo control on multi-axis applications.
- Identical outcomes when utilizing one or all axes of motion.
- Configurable PID filter with feed forward coefficients.

266 MHz, 32-bit RISC processor

- Updates all signals and data points providing superior application control.

Controller I/O Capabilities

- Each axis has +Limit, -Limit, Home, Auxiliary out, and axis control out.
- 16 General purpose bi-directional TTL I/O
- 2 General purpose analog output with 16 bit, +/-10 VDC input (in addition to axes output).
- 4 Channels of general purpose analog input with 16-bit (+/-10 VDC)

Motion Feedback

- Each axis has an incremental encoder input
- Quadrature Encoder Feed back up to 16 MHz on all encoder inputs.
- Absolute encoder feedback (options for all axes up to 32-bit resolution)

Sophisticated Control Functionality

- 16 bit DAC analog resolution.
- Step pulses from 0 to 4,194,176 steps per second (+/- 0 steps).
- Backlash compensation.
- Custom, parabolic, “S”-Curve & linear trajectory profiles.
- Real time encoder position capture.
- S-Curve with 4-quadrant jerk parameters.

Control signals

- Two 100-pin SCSI type connectors for high density signal connection.
- 16 “user definable” digital I/O.
- Analog out per each axis can be used as general purpose when axis is configured for Step control.

ADDITIONAL FEATURES

- Small form-factor, 4” x 6.5” x 1.64”
- Stand-alone capability
- Custom Power-up Defaults
- Non-Volatile Macro Storage
- Patented technology to minimize torque ripple and velocity modulation
- Internal Watchdog timer for safety
- Slip & Stall detection with encoder feedback
- Linear/Circular interpolation
- Constant and variable velocity contouring (all axes)
- Single-axis, multi-axis and multi-tasking modes
- Output is +/-10V, or Step & Direction per Axis
- Independent home and plus / minus over-travel inputs for each axis
- Auxiliary output per axis for Amp/Drive enable
- Commands are intuitive for programming ease.
- Over 250 ASCII character commands, “universal” to current and previous OMS controllers
- Capable of conversion to “user” defined units i.e. inches/ revolutions if desired.
- Designed for expandability (custom solutions)
- Person to person toll-free tech support: 800-707-8111
- OMS has more than 28 years proven success

DESCRIPTION

The MAXnet family of Motion Controllers has been expanded to provide up to 10 axis of intelligent motion control. A powerful 266 MHz 32 Bit RISC processor (PowerPC) provides the capability and power for better and more sophisticated application control. This newest generation of motion control products provides up to 10 axes of motion control on a two board stack of 4 x 6.5 x 1.64 inches. Each axis can be selected by the user to be an open or closed stepper or a high capability servo axis. In addition, independent analog inputs are provided to enable integration of analog parameters such as velocity override, temperature, pressure, etc., under the control of the running application. Two additional general purpose analog outputs are also provided.

Outputs are provided for 16 bit analog servo output as well as step and direction for stepper system applications. The servo loop is a PID filter with several coefficients and an update rate of 122 μs on all 10 axes. Independent plus and minus limits, a home switch input, and an auxiliary output provided for each of the 10 axes so that the state of any of them can be monitored by the system at any time. An additional 16 User Definable I/O is available for synchronization and control of other events. Incremental encoder feedback, differential or single ended, is used for all servo axes and is available for position feedback and may also be used for slip or stall detection.

PROGRAMMING

The MAXnet motion controllers are easily programmed with character ASCII commands through an extensive command structure. The commands are combined into character strings to create sophisticated motion profiles, with features such as IO and other functionality. A separate FIFO command queue for each axis is used to store the commands once they are parsed in the MAXnet. These commands are then executed sequentially, allowing the host to send a complex command sequence and attend to other tasks, while the MAXnet manages the motion process. These command queues can store 2559 command values and can include a loop counter that allows multiple execution of any command string.

There are approximately 250 commands available. All commands are sent to the controller as two or three character strings. Some of these commands expect one or more numerical operands to follow. These commands are identified with"#" after the command in the description. The "#" indicates a signed integer input parameter, or a signed fixed point number of the format ##.# when User Units are enabled. User Units define distances, Velocity and Acceleration parameters, and represent the input in Inches, millimeters, revolution, etc.

Synchronized moves may be made by entering the AA or AM command mode. This form of the command performs a context switch that allows entering commands in the format MRx#,y#,z#,t#,u#,v#,r#,s#,w#,k#;
Numbers are entered for each axis commanded to move. An axis may be skipped by entering a comma {,} at the appropriate axis position with no value parameter. The command may be prematurely terminated with a semicolon (;) i.e. a move requiring only the X and Y axes to move would use the command MRx#,y#; followed by the GO command. Each axis programmed to move will start together upon execution of the GO command. The MAXnet can be switched back to independent-axis mode by entering the desire single axis command, such as AX.

PROGRAMMING EXAMPLES

In a typical move requirement where it is desired to home the stage and then move to a specified position, the following will demonstrate the programming for a single axis:
Initialize the velocity and acceleration parameters to a suitable value. Set the PID filter gain values. Perform the homing operation initializing the position counter to zero. Perform a motion to the absolute position of 10,000 and set the done flag for that axis when the move is finished.

```
AX;
VL5000;
AC50000;
KP20;
KI1;
KD45;
HN;
HM0;
MA10000;
GO;
ID;
```

In a move requiring a three axis coordinated move to a position, the following could be used:

```
AX;
KP2;
KD6;
HN;
AY;
KP2;
KD6;
HN;
AZ;
KP2;
KD6;
HN;
AM;
VL5000,5000,5000;
AC50000,50000,50000;
MA1000,2000,3000;
GO;
ID;
```

The controller would calculate the relative velocities required to perform a straight line move from the current position to the desired position.

SPECIFICATIONS

Velocity

0 to 4,194,176 pulses per second simultaneous on each axis

Acceleration

0 to 8,000,000 pulses per second per second

Position range

± 2,147,487,647

Accuracy

Position accuracy and repeatability ±0 counts for point to point moves

Velocity accuracy ±0.01% of peak velocity in jog mode.

Environmental

Operating temperature range: 0 to 50 degrees centigrade

Storage temperature range: -20 to 85 degrees centigrade

Humidity: 0 to 90% non-condensing

Power

+5VDC +/-5% at 1.5 amp typical
+12VDC at 0.2 amp typical = +/-5%
-12VDC at 0.2 amp typical = +/-5%

Dimensions

4" x 6.5" x 1.67"

Limit switch inputs

TTL input signals
Active low or high, selectable by command input for each axis (active low is default)

Connector

Two shielded 100-Pin SCSI type connectors for all signals (motor control, I/O, Limits, etc). Breakout board available for ease of cabling.

Home switch inputs

TTL input signals
Active low or high, selectable by command input for each axis (active low is default)

User definable I/O

Up to 16 bits of user definable digital I/O. The 16 bits are user configurable and are configured as 4 inputs and 4 outputs on each of the two boards for a total of 16 I/O as defaults from the factory.

Analog inputs

Up to four independent analog inputs, 16-Bit resolution, +/- 10V.

Analog outputs (servo)

+/-10V and 0 to +10V, max. One per axis plus two general purpose, all are 16 Bit resolution

Step pulse output

Pulse width 50% duty cycle. Open collector level signal (TTL).

Direction output

Open collector level signal (TTL).

Encoder feedback

Maximum 16 MHz after 4x quadrature detection. Differential signal.
Two 12-bit Absolute (SSI) encoder channels by default (optional 32-bit absolute encoders available for all axes).

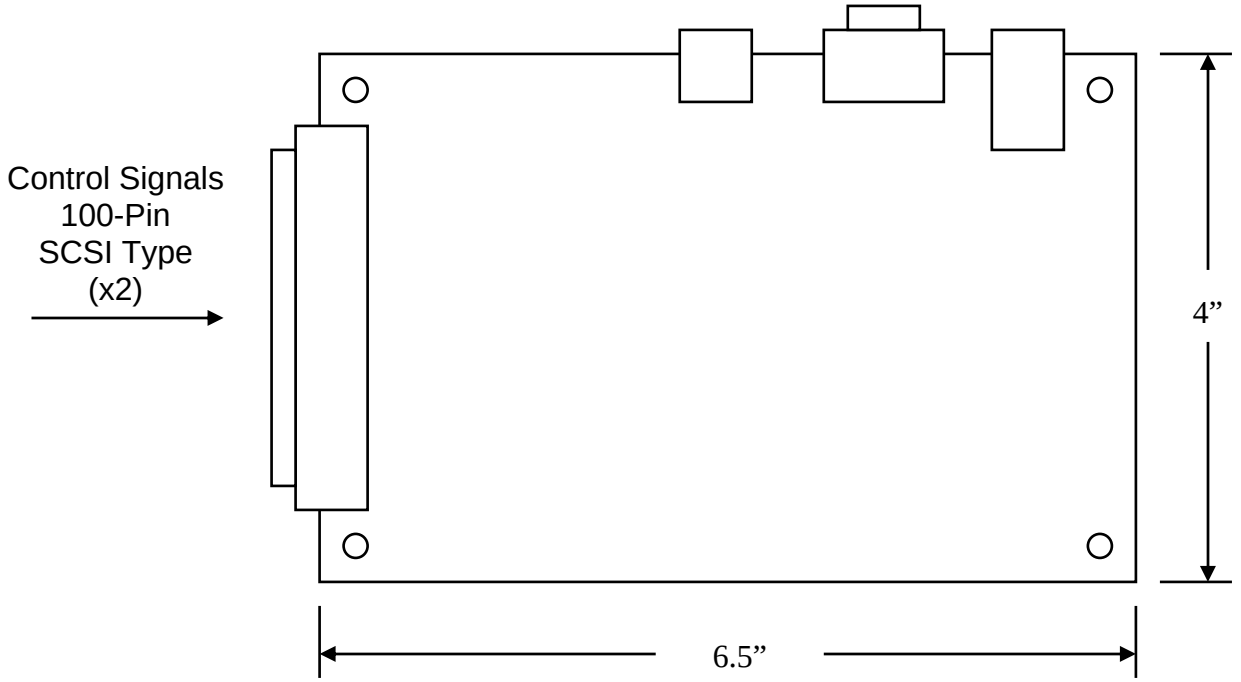
Reference

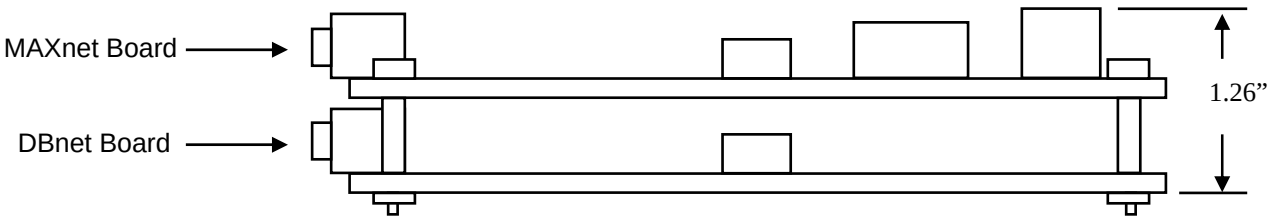
IEEE 802

Software

Software interface utilities provided.
High level expertise not required.
Over 250 ASCII character commands, expanded from current OMS command set while backwards compatible.

"The Company in Motion"



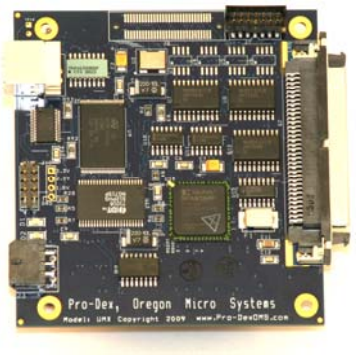


Dimensions are approximate

Ordering Information	
Model	No. of Axes
MAXnet-1000	1
MAXnet-2000	2
MAXnet-3000	3
MAXnet-4000	4
MAXnet-5000	5
MAXnet-6000	6
MAXnet-7000	7
MAXnet-8000	8
MAXnet-9000	9
MAXnet-A000	10

ACCESSORIES	
IOMAXnet	I/O Breakout Board for MAXnet
CBL58-3M	I/O cable for MAXnet to IOMAXnet, 3 meters
CBLMAX-12	I/O cable for MAXnet to IOMAXnet, 12 inches

3701-1800001
Revision B



UMX

USB Multi-Axis Motion Controller

FEATURES

Controller capabilities
- Four axes of stepper control with encoder feedback or servo control
- Encoder feedback to 12MHz

Communications
- USB 2.0
- Plug and Play
- Stand-alone

Sophisticated Control Functionality
- 16 bit DAC analog resolution
- Independent and coordinated motion of all axes at the same time
- Slip & Stall detection with encoder feedback
- Crystal controlled step pulse from 0 to 1,044,000 steps per second
- Circular interpolation
- Constant velocity linear interpolation (all axes)
- Electronic gearing

32 bit Processor for Extensive Co-Processing
- Does not burden the host with overhead
- Custom, parabolic, cosine, linear trajectory profiles
- Patented technology to minimize torque ripple and velocity modulation
- Internal watchdog timer for safety

Flash Memory
- Field upgradeable firmware within Windows operating systems
- Non-volatile program storage and parameter storage

Control signals
- Single high density shielded SCSI3 connector
- Up to 12 user I/O
- Motion Control Output is +/-10V or 0-10V Servo or Step & Direction
- Dedicated home and plus / minus over-travel inputs for each axis

Software and Firmware
- High level programming expertise not required
- Over 150 commands, “universal” to all OMS controllers
- Commands are ASCII characters
- Capable of conversion to “user” defined units i.e. inches / revolutions
- Software for Windows© 95/98, NT, 2000, XP and Vista.
- Software supplied at no additional cost

Flexible and Expandable
- Small form factor, 3.55” x 3.3”
- Customizable solutions available for your requirements

Factory Direct Technical Support
- Person to person toll-free tech support: call 800-707-8111
- Application notes and Documentation on the Web
- Example programs and application code provided
- All Pro-Dex, OMS controls are 100% tested and quality inspected

DESCRIPTION

The UMX controller is compatible with the PC78 and PCIx controller families with 2-4 axes control. The UMX supports up to 12 general purpose TTL I/O bits, 8 of which are user definable.

The step pulse is a TTL level 50% duty cycle square wave that supports velocities of 0 through 1,044,000 pulses per second. The encoder feedback functionality supports quadrature encoders up to 12 MHz at a 4 times the encoder line resolution and is used as closed-loop feedback for the stepper axes or as independent position feedback. The encoder feedback can provide slip and/or stall detection. Each axis includes dedicated +/- overtravel inputs, a home input, and an auxiliary output.

PROGRAMMING

UMX motion controllers are easily programmed with 2 and 3 character ASCII commands through an extensive command structure. The commands are combined into character strings to create sophisticated motion profiles and are passed to the UMX controller. A separate 'FIFO' command queue for each axis is used to store the parsed commands by the UMX until they are executed allowing the host to send a complex command sequence and attend to other tasks while the UMX manages the motion process. These command queues store 200 command and parameter words and include a command loop counter which allows multiple executions of any command string.

The following commands are available in the UMX family of motion controllers. Some commands expect one or more numerical operands to follow. These commands are identified with a '#' after the command. The '#' indicates a signed integer input parameter or a signed fixed point number of the format ##.# when user units are enabled. With user units defined, distances, velocity and acceleration parameters may be input in inches, revolutions, etc.*

Synchronized moves may be made by entering the AA or AM command. This command performs a context switch which allows entering commands of the format MRx#,y#,z#,t#;. Numbers are entered for each axis which is to be commanded to move. An axis may be skipped by entering the comma with no parameter. The command may be prematurely terminated with a ";", i.e. a move requiring only the X and Y axes would use the command MRx#,y#; followed by the GO command. Each axis programmed to move will start together upon executing the GO command. The UMX can be switched back to the unsynchronized mode by entering the desired axis command such as AX.

PROGRAMMING EXAMPLES

In a typical move requirement where it is desired to home the stage then move to a specified position, the following will demonstrate the programming:
Initialize the velocity and acceleration parameters to a low value suitable for homing. Set a PID filter proportional gain of 2 and a derivative gain of 6. Perform the home operation initializing the position counter to zero.
Initialize the velocity and acceleration parameters to perform a faster motion and move to an absolute position of 10,000 counts from home in the positive direction and set the done flag when finished.
The following would be input from the host computer:

```
AX;
VL1000;
AC10000;
KP2;
KD6;
HN;
HM0;
VL5000;
AC50000;
MA10000;
GO;
ID;
```

In a move requiring a three axis coordinated move to a position in free space the following could be used:

```
AX;
KP2;
KD6;
HN;
AY;
KP2;
KD6;
HN;
AZ;
KP2;
KD6;
HN;
AM;
VL5000,5000,5000;
AC50000,50000,50000;
MT1000,2000,3000;
GO;
ID;
```

The controller would calculate the relative velocities required to perform a straight line move from the current position to the desired position.

* The user manual has all commands listed and should be used to program the Motion Controller.

SPECIFICATIONS

Velocity
0 to 1,044,000 counts per second simultaneous on each axis

Acceleration
0 to 8,000,000 counts per second per second

Position range
67,000,000 counts (±33,500,000)

Accuracy
Position accuracy and repeatability ±0 counts for point to point moves
Velocity accuracy ±0.01% for step pulse output

Environmental
Operating temperature range: 0 to 50 ºC
Storage temperature range: -20 to 85 ºC
Humidity: 0 to 90% non-condensing

Power
+5VDC @ 1 A typical
+/-12VDC @ 0.2 A typical

Dimensions
3.25 x 3.55 x 0.5 inches

Communication
USB 2.0: software drivers included

Limit switch inputs
TTL input levels with on board 2.2K pull up resistor, requires only external switch closure to ground or TTL level input signal. Input sense (low or high true) selectable by command input for each axis.

Home switch inputs
TTL input levels with on board 2.2K pull up resistor, requires only external switch closure to ground or TTL level input signal. Input sense (low or high true) selectable by command input for each axis.

User definable I/O
12 bits of user definable I/O. 8 bits are user configurable as inputs or outputs. One auxiliary output per axis and are fixed as outputs. Factory default is 4 inputs, 4 outputs and 1 auxiliary per axis.
TTL input levels with on board 2.2K pull up resistor, requires only external switch closure to ground or TTL level input signal.
The auxiliary outputs are TTL open collector outputs (7406, max 48mA). The other outputs are TTL totem pole outputs (74LS243, max 24mA).

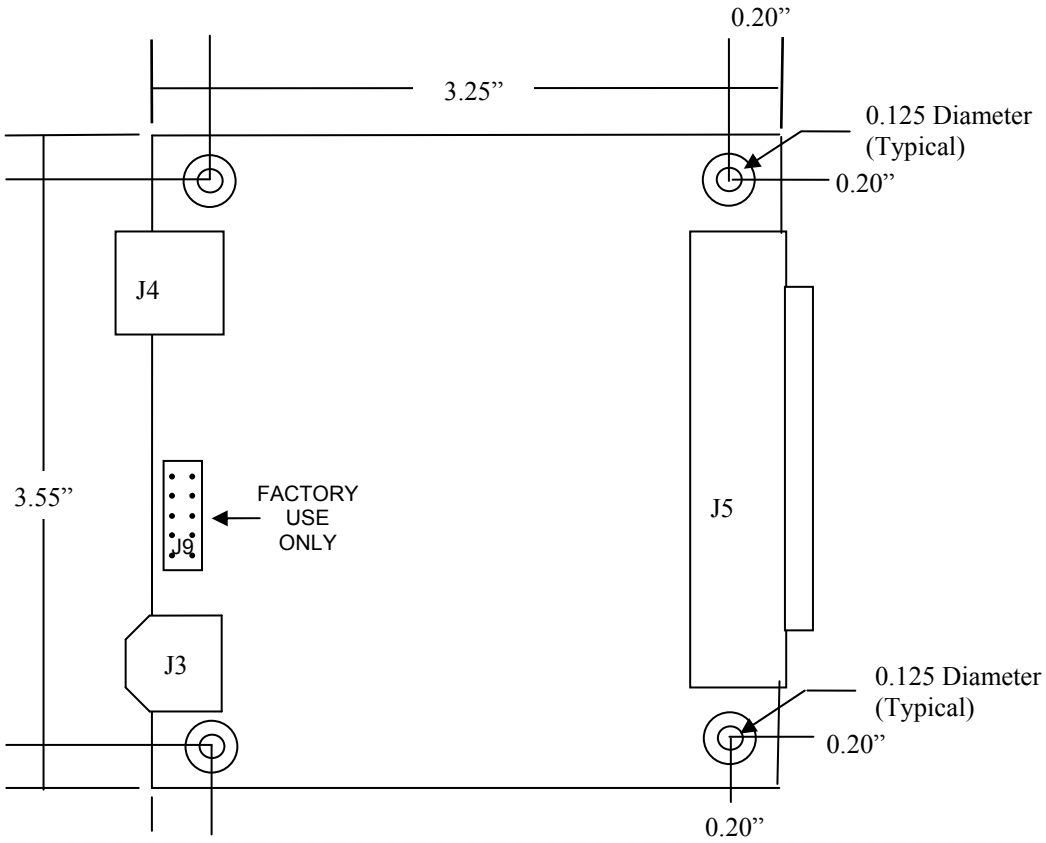
Step pulse output
Pulse width 50% duty cycle. Open collector TTL level signal (7406, max 48mA).

Direction output
Open collector TTL level signal (7406, max 48mA).

Encoder Feedback
Maximum 12 MHz after 4x quadrature detection
Differential TTL level signal MC26G32, max 150mA

"The Company in Motion"

Actual Size Depiction below



ORDERING INFORMATION

Pro-Dex OMS. - UMX Motion Controls				
MODEL	SERVO AXES	STEPPER AXES		USER I/O
		CONTROL	FEEDBACK	
UMX-25	2	0	0	12
UMX-26	0	2	2	12
UMX-45	4	0	0	12
UMX-46	0	4	4	12

ACCESSORIES	
MODEL	DESCRIPTION
IO68-M	I/O Breakout board for standard UMX motion control boards
CBL68-10	10 ft cable w/mating connector 68 pin, (IO68/UMX)
CDSWSUPP	Software drivers for Windows XP, Windows Vista and Windows 7.
CDMAN	Electronic Manual 1 per shipment provided, unless otherwise requested

3701-3200000
Revision A

Pro-Dex Oregon Micro Systems™

FEATURES

MAXp

Intelligent 8-Axis Motion Controller for PCI

- **PID update rate of 122 μs on all 8 axes**
  Delivers exceptional servo control on multi-axis applications. Identical outcomes when utilizing one or all axes of motion. Configurable PID filter with feedforward coefficients.
- **266 MHz, 32-bit RISC processor**
  Updates all signals and data points providing superior application control. An order of magnitude faster than our competition.
- **64k Shared Memory**
  Permits rapid data transfer to & from controller. Large size accommodates expandability to unique and custom applications.
- **PCI Universal Bus - 3.3 or 5.0 volts**
  PCI Rev 2.2 compliant. Compatible with current and future PCI bus computers.
- **Memory**
  32 Mb System Memory.
- **Controller I/O Capabilities**
  4 Channels of general purpose Analog Input, with 16 bit, +/-10 VDC input
  Up to 8 Analog outputs, +/- 10 VDC output
  16 user-definable digital I/O
  Home and Limit for each axis
- **Motion Feedback**
  Support Quadrature Encoder Feed back up to 16 MHz.
- **Sophisticated Control Functionality**
  16 bit DAC analog resolution. Step pulses from 0 to 4,176,000 steps per second (+/- 0 steps). Backlash compensation. Custom, Parabolic, "S"-curve & Linear trajectory profiles. Real time encoder position capture. S-Curve with 4-quadrant jerk parameters.
- **Control signals**
  Opto-isolated Digital I/O. High density shielded 120 pin connector

Additional Features

- All communication via Device Driver and Driver Support DLL.
- Dual Port RAM is utilized for high-speed communications
- PCI 33 MHz Target Device
- Independent and coordinated motion of all axes.
- Slip & Stall detection with encoder feedback.
- Patented technology to minimize torque ripple and velocity modulation.
- Many control signals are opto-isolated.
- Independent home, positive and negative over-travel inputs.
- Non-volatile macro storage, parameter storage.
- Linear/Circular interpolation
- Constant or Variable Velocity contouring (all axes)
- 120 Pin I/O Breakout Module
- Field upgradable firmware
- Firmware upgrades and enhancements
- Customizable solutions available for your requirements
- Example programs and application code provided
- Web page support for downloading software and documentation
- Person to person toll-free tech support - call 800-707-8111

DESCRIPTION

The MAXp is a full length PCI bus motion controller that conforms to the PCI Local Bus specification, rev 2.2. The MAXp is capable of up to 8-axis of control of which each axis can be configured as an open loop stepper, a closed loop stepper, or a servo axis.

The MAXp is powered by a PowerPC processor. This high performance processor provides a 64-bit Floating Point processor and is clocked at 266MHz. This provides the MAX with the pure processing power to update every signal of the controller, i.e. I/O bits, direction, limits, etc., at rates of 122µs.

The MAXp supports 16 general purpose digital I/O signals which are opto-isolated for optimum noise immunity. The home and overtravel inputs are also opto-isolated. In addition it has four general purpose analog inputs that can be used to sense Pressure Transducers, Dial Switches, etc. Analog inputs can also be used to control velocity override. These analog inputs have 16-bit resolution with +/- 10 VDC input.

Each axis has servo output signal capability; configured as a +/- 10V or 0-10V signal and is driven by a 16-bit DAC. The servo control loop is a PID filter with feedforward coefficients and an update rate of 122µs. The step pulse is a TTL level, 50% duty cycle square wave that supports velocities of 0 through 4,176,000 pulses per second. Encoder feedback functionality supports quadrature encoders up to 16 MHz and is used as the servo feedback, as feedback for the stepper axes or as independent position feedback. Encoder feedback is also used to provide slip and or stall detection. Every axis includes dedicated +/- over travel inputs, a home input, and an auxiliary output. The MAXp is available in several different models that support a different number of axes.

PROGRAMMING

MAXp motion controllers are easily programmed with ASCII character commands through an extensive command structure. These commands are combined into character strings to create sophisticated motion profiles with features of I/O and other functionality. A separate FIFO command queue for each axis is used to store the commands once they are parsed by the MAXp. The commands are executed sequentially, allowing the host to send a complex command sequence and attend to other tasks while the MAXp manages the motion process. These command queues store 2559 command values and include a command loop counter which allows multiple executions of any queued command.

All commands are sent to the controller as two or three character ASCII strings. Some of these commands expect one or more numerical operands to follow. These commands are identified with a '#' after the command. The '#' indicates a signed integer input parameter or a signed fixed point number of the format ##.# when user units are enabled. User Units define, distances, velocity and acceleration parameters and may be inputted in inches, millimeters, revolutions, etc.

Synchronized moves may be made by entering the AA or AM command mode. This form of the command performs a context switch that allows entering commands of the format

MRx#,y#,z#,t#; u#, v#, r#, s#;

Numbers are entered for each axis commanded to move. An axis may be skipped by entering the comma with no parameter. The command may be prematurely terminated with a ";", i.e. a move requiring only the X and Y axes would use the command MRx#,y#; followed by the GO command. Each axis programmed to move will start together upon executing the GO command. The MAXp can be switched back to the independent-axis mode by entering the desired single axis command such as AX.

PROGRAMMING EXAMPLES

In a typical move requirement where it is desired to home the stage then move to a specified position, the following will demonstrate the programming for a single axis:

- Initialize the velocity and acceleration parameters to a suitable value. Set a PID filter gain values. Perform the home operation initializing the position counter to zero. Perform a motion to an absolute position of 10,000 and set the done flag for that axis when the move is finished.

  The following would be input from the host computer:

  ```
  AX;
  VL5000;
  AC50000;
  KP20;
  KI1;
  KD45;
  HN;
  HM0;
  MA10000;
  GO;
  ```

In a ID; move requiring a three axis coordinated move to a select position the following commands could be used:

```
AM;
VL5000,5000,5000;
AC50000,50000,50000;
MT1000,2000,3000;
GO;
ID;
```

The controller would calculate the relative velocities required to perform a straight line move from the current position to the desired absolute position so that all axes arrive at their destinations at the same time.

The following demonstrates cutting a hole with a 10,000 count radius using constant velocity contouring and circular interpolation:

- The contouring velocity is set to 1000 counts per second. A contour is defined beginning at coordinates 0,0 on the Z and T axes.

- Auxiliary output on the X axis is turned on, which could turn on the cutting torch or laser starting the cut at the center of the circle.
- A half circle is cut from the center to the outside of the hole positioning the cutting tool at the start of the hole.
- The hole is then cut, the torch turned off, the stage stopped and the contour definition completed.
- The stage is then positioned and the contour definition executed.

The following would be input from the host computer:

```
AA;
CV1000;
CD,,0,0;
AN;
CR0,5000,-3.1415926;
CR0,0,-6.2831853;
AF;
MT-10,10000;
CE;
MT,,-1000,0;
GO;
CX;
```

SPECIFICATIONS

Velocity

0 to 4,176,000 pulses per second simultaneous on each axis

Acceleration

0 to 8,000,000 pulses per second per second

Position range

± 2,147,487,647

Accuracy

Position accuracy and repeatability ±0 counts for point to point moves

Velocity accuracy ±0.01% of peak velocity in jog mode.

Environmental

Operating temperature range: 0 to 50 degrees centigrade

Storage temperature range: -20 to 85 degrees centigrade

Humidity: 0 to 90% non-condensing

Power

+5VDC +/-5% at 1 amp typical
+3.3VDC +/-0.3% at amps typical
+12VDC at 0.1 amp typical = +/-5%
-12VDC at 0.1 amp typical = +/-10%

Dimensions

12.283" x 4.200" x 0.475"
312 mm x 106mm x 12.06 mm

Communication Interface

Meets all signal specifications for PCI bus Specifications, Rev. 2.2.

Limit switch inputs

Opto-isolated TTL input levels (Opto, max 50mA). Input sense (low or high true) selectable by command input for each axis.

Connector

Single HI Density Shielded 120-Pin connector for all motor control functions. Mating connector and Strain Relief Hood. Separate 25-Pin D-Sub connector for all Digital I/O functions.

Home switch inputs

Opto-isolated TTL input levels (Opto, max 50mA). Input sense (low or high true) selectable by command input for each axis.

User definable I/O

Up to 16 bits of user definable Digital I/O. All bits are opto-isolated. 16 bits are user configurable that are configured as 8 inputs and 8 outputs from the factory. These signals are passed through an optocoupler with a maximum input forward current of 50mA and a maximum output emitter-collector voltage of 35V and 50mA collector current.

Analog inputs

Four independent analog inputs, 16 Bit resolution

Analog outputs

+/-10V and 0 to +10V,max. 1mA each. One per axis.

Step pulse output

Pulse width 50% duty cycle. Open collector TTL level signal (7406, max 48mA).

Direction output

Open collector TTL level signal (7406, max 48mA).

Encoder Feedback

Maximum 16 MHz after 4x quadrature detection. Differential TTL level signal (26LV32, max 15mA).

Reference

PCI specification, Rev. 2.2.
PCB mechanical specification, IEEE 1101.1, 1101.10 and P1101.11

Software

High level expertise not required.

Over 200 ASCII character commands, expanded from current OMS command set.

Software drivers and DLLs for Windows® provided at no additional cost.

User Manual included.

Servo Tuning Assistant software tools included at no additional cost.

Support software available for download at our web-site (www.pro-dex.com)

Part Number: 3701-0900000
Revision D

120-Pin CONTROL SIGNAL CONNECTOR (J2)			
Description	PIN	PIN	Description
Step- R	2	1	Step-S
Direction - R	4	3	Direction-S
Phase A +R	6	5	+5 VDC
Phase A - R	8	7	Phase A +S
Phase B +R	10	9	Phase A - S
Phase B - R	12	11	Phase B +S
Index +R	14	13	Phase B - S
Index - R	16	15	Index +S
T-Negative Limit	18	17	Index - S
Analog Input 2	20	19	Z-Negative Limit
Ground	22	21	T-Positive Limit
Analog Input 3	24	23	U-Positive Limit
Ground	26	25	V-Positive Limit
Analog Input 4	28	27	R-Positive Limit
U-Negative Limit	30	29	S-Positive Limit
Step- U	32	31	Step- V
Direction - U	34	32	Direction-V
+5 VDC	36	35	+5 VDC
Phase A +U	38	37	Phase A +V
Phase A - U	40	39	Phase A - V
Phase B +U	42	41	Phase B +V
Phase B - U	44	43	Phase B - V
Index +U	46	45	Index +V
Index - U	48	47	Index - V
Z-Positive Limit	50	49	X-Positive Limit
R-Servo	52	51	Y- Positive Limit
Ground	54	53	U-Home
S-Servo	56	55	V- Home
Ground	58	57	R-Home
Analog Input 1	60	59	S-Home

120-Pin CONTROL SIGNAL CONNECTOR (J2)			
Description	PIN	PIN	Description
Step-Z	62	61	+5 VDC
Direction -Z	64	63	Step- T
Phase A +Z	66	65	Direction - T
Phase A - Z	68	67	Phase A +T
Phase B +Z	70	69	Phase A - T
Phase B - Z	72	71	Phase B+T
Index +Z	74	73	Phase B - T
Index - Z	76	75	Index +T
Y-Negative Limit	78	77	Index - T
T-Servo	80	79	X-Home
Ground	82	81	Y-Home
U-Servo	84	83	Z-Home
Ground	86	85	Auxiliary - V
V-Servo	88	87	Auxiliary - R
T-Home	90	89	Auxiliary - S
V-Negative Limit	92	91	Step -Y
R-Negative Limit	94	93	Direction -Y
S-Negative Limit	96	95	Step -X
Phase A +X	98	97	Direction -X
Phase A -X	100	99	Phase A + Y
Phase B +X	102	101	Phase A –Y
Phase B - X	104	103	Phase B +Y
Index +X	106	105	Phase B -Y
Index - X	108	107	Index + Y
X Negative Limit	110	109	Index - Y
X-Servo	112	111	Auxiliary - X
Ground	114	113	Auxiliary - Y
Y-Servo	116	115	Auxiliary - Z
Ground	118	117	Auxiliary - T
Z-Servo	120	119	Auxiliary - U

25-Pin Digital I/O Connector (J5)			
Description	PIN	PIN	Description
Ground	1	2	I/O 8
I/O 0	3	4	I/O 9
I/O 1	5	6	+5 VDC
+5 VDC	7	8	I/O 10
I/O 2	9	10	I/O 11
I/O 3	11	12	+5 VDC
Ground	13	14	I/O 12
I/O 4	15	16	I/O 13
I/O 5	17	18	+5 VDC
+5 VDC	19	20	I/O 14
I/O 6	21	22	I/O 15
I/O 7	23	24	Ground
Ground	25	26	No Connect

ORDERING INFORMATION

Model	Computer Interface	Axes	Servo / Stepper	I/O					
				Limit	Auxiliary	Home	Digital General Purpose	Analog In	Analog Out
MAXp-1000	Universal PCI	1	User Definable	2	1	1	16	4	1
MAXp-2000		2	User Definable	4	2	2	16	4	2
MAXp-3000		3	User Definable	6	3	3	16	4	3
MAXp-4000		4	User Definable	8	4	4	16	4	4
MAXp-5000		5	User Definable	10	5	5	16	4	5
MAXp-6000		6	User Definable	12	6	6	16	4	6
MAXp-7000		7	User Definable	14	7	7	16	4	7
MAXp-8000		8	User Definable	16	8	8	16	4	8
IOMAX	120-Pin Connector Breakout Module								

Pro-Dex
Accelerating Possibilities
OREGON MICRO SYSTEMS

MAXv

Intelligent 8-Axis Motion Controller for VME Bus

FEATURES

PID update rate of 122 μs on all 8 axes

- Delivers exceptional servo control on multi-axis applications.
- Identical outcomes when utilizing one or all axes of motion.
- Configurable PID filter with feed forward coefficients.

266 MHz, 32-bit RISC processor

- Updates all signals and data points providing superior application control.

4032 Bytes of Dual Port RAM

- Permits rapid data transfer to & from controller.
- Large size accommodates expandability to unique and custom applications.

VME64 Specification

- The 160-pin P1/P2 connectors provide high density connectivity on the back plane.
- VME and VME64 compliant

Controller I/O Capabilities

- 6 Channels of general purpose analog input with 16 bit, +/-10 VDC input
- 2 Channels of general purpose analog output with 16-bit +/-10 VDC output.

Motion Feedback

- Support Quadrature Encoder Feed back up to 16 MHz on up to 10 encoder inputs.

Sophisticated Control Functionality

- 16 bit DAC analog resolution.
- Step pulses from 0 to 4,176,000 steps per second (+/- 0 steps).
- Backlash compensation.
- Custom, parabolic, “S”-Curve & linear trajectory profiles.
- Real time encoder position capture.
- S-Curve with 4-quadrant jerk parameters.

Control signals

- Two 68-pin SCSI3 and one 50-pin SCSI2 connectors for high density signal connection on the front panel.
- 16 “user definable” digital I/O.
- P2 connector is 160-pins and supports most of the signals available on the front panel.

ADDITIONAL FEATURES

- Consumes a single VME (6U) slot
- Interface port VME P1 and P2 supports both 96 Pin and 160 pin connectors.
- Supports A16, A24 and A32 Addressing modes.
- Non-Volatile Macro Storage
- VME64bus specification ISO/IEC 15776:2001(E).
- Motion parameters continuously available in shared RAM for real time profile status.
- Electronic “mailbox” in shared RAM for priority commands, i.e. abort
- Patented technology to minimize torque ripple and velocity modulation
- Internal Watchdog timer for safety
- Slip & Stall detection with encoder feedback
- Linear/Circular interpolation
- Constant and variable velocity contouring (all axes)
- Axis control signals are also on P1 & P2 connector.
- Output is +/-10V, or Step & Direction per Axis
- Independent home and plus / minus over-travel inputs for each axis
- Commands are intuitive for programming ease.
- Over 150 ASCII character commands, “universal” to current and previous OMS controllers
- Capable of conversion to “user” defined units i.e. inches/ revolutions if desired.
- Person to person toll-free tech support: 800-707-8111

DESCRIPTION

The MAXv family of Motion Controllers brings the Oregon Micro Systems, Inc. (OMS) intelligent motion control technology to a new level of servo applications as well as stepping motors. A much more powerful 266 MHz 32 Bit RISC processor (PowerPC) provides the capability and power for better and more sophisticated application control. This new generation of motion control products provides up to 8 axes of motion control on a single card to VME bus compatible computers. Each axis can be selected by the user to be an open or closed stepper or a high capability servo axis. In addition, independent analog inputs are provided to enable integration of analog parameters such as velocity override, temperature, pressure, etc., under the control of the running application. Two additional encoder inputs are available for increased precision and control. Two additional general purpose analog outputs are available.

Outputs are provided for 16 bit analog servo output as well as step and direction for stepper system applications. The servo loop is a PID filter with feed-forward coefficients and an update rate of 122 μs on all 8 axes. Independent plus and minus limits, a home switch input, and an auxiliary output provided for each of the 8 axes so that the state of any of them can be monitored by the system at any time. An additional 16 User definable I/O is available for synchronization and control of other events. The voltage range of limit and home circuits has been extended for operation in the 3 to 30 VDC range. Incremental encoder feedback, differential or single ended, is used for all servo axes and is available for position feedback and may also be used for slip or stall detection.

The bus interface uses Shared Memory technology for communication of commands from the host and feedback of motion control parameters. Commands may be written to this Shared Memory by the host, eliminating the communication bottlenecks of single address port-based communications.

The MAXv uses the PowerPC's Message unit including the door-bell technology to alert and flag the host or the Controller. Interrupt control and other data are available through reserved storage regions in the common memory area. These include the interrupt vector, interrupt control and status done flag data, over travel and home switch status, Command Error, an ASCII Command and an ASCII Response Ring Buffer, slip flag for each axis as well as the user definable I/O. Some commands may be passed to the MAXv, by passing the communication channel using the mailbox system. These commands cause an immediate interrupt and may be used for critical commands such as abort. Each axis may perform individual unrelated moves or they can be coordinated as required by the application.

PROGRAMMING

The MAXv motion controllers are easily programmed with character ASCII commands through an extensive command structure. The commands are combined into character strings to create sophisticated motion profiles, with features such as IO and other functionality. A separate FIFO command queue for each axis is used to store the commands once they are parsed in the MAXv. These commands are then executed sequentially, allowing the host to send a complex command sequence and attend to other tasks, while the MAXv manages the motion process. These command queues can store 2559 command values and can include a loop counter that allows multiple execution of any command string.

All commands are sent to the controller as two or three character strings. Some of these commands expect one or more numerical operands to follow. These commands are identified with"#" after the command. The "#" indicates a signed integer input parameter, or a signed fixed point number of the format ##.# when User Units are enabled. User Units define distances, Velocity and acceleration parameters, and represent the input in Inches, millimeters, revolution, etc.

Synchronized moves may be made by entering the AA or AM command mode. This form of the command performs a context switch that allows entering commands in the format MRx#,y#,z#,t#,u#,v#,r#,s#;

Numbers are entered for each axis commanded to move. An axis may be skipped by entering a comma {,} at the appropriate axis position, with no value parameter. The command may be prematurely terminated with a semicolon (;) i.e. a move requiring only the X and Y axes to move would use the command MRx#,y#; followed by the GO command. Each axis programmed to move will start together upon execution of the GO command. The MAXv can be switched back to independent-axis mode by entering the desire single axis command, such as AX.

PROGRAMMING EXAMPLES

In a typical move requirement where it is desired to home the stage and then move to a specified position, the following will demonstrate the programming for a single axis:

Initialize the velocity and acceleration parameters to a suitable value. Set the PID filter gain values. Perform the homing operation initializing the position counter to zero. Perform a motion to the absolute position of 10,000 and set the done flag for that axis when the move is finished.

```
AX;
VL5000;
AC50000;
KP20;
KI1;
KD45;
HN;
HM0;
MA10000;
GO;
ID;
```

In a move requiring a three axis coordinated move to a position, the following could be used:

```
AX;
KP2;
KD6;
HN;
AY;
KP2;
KD6;
HN;
AZ;
KP2;
KD6;
HN;
AM;
VL5000,5000,5000;
AC50000,50000,50000;
MA1000,2000,3000;
GO;
ID;
```

The controller would calculate the relative velocities required to perform a straight line move from the current position to the desired position.

SPECIFICATIONS

Velocity

0 to 4,176,000 pulses per second simultaneous on each axis

Acceleration

0 to 8,000,000 pulses per second per second

Position range

± 2,147,487,647

Accuracy

Position accuracy and repeatability ±0 counts for point to point moves

Velocity accuracy ±0.01% of peak velocity in jog mode.

Environmental

Operating temperature range: 0 to 50 degrees centigrade

Storage temperature range: -20 to 85 degrees centigrade

Humidity: 0 to 90% non-condensing

Power

+5VDC +/-5% at 1 amp typical
+12VDC at 0.1 amp typical = +/-5%
-12VDC at 0.1 amp typical = +/-10%

Dimensions

6.4" x 9.2" x 0.7"

Limit switch inputs

Input levels 3-30 VDC Input sense (low or high true) selectable by command input for each axis.

Connector

Two shielded 68-Pin SCSI3 connectors for all motor control, one 50-Pin SCSI2 connector for I/O signals on front panel, and a 160-pin P2 connector for back plane interconnect.

Home switch inputs

Input levels 3-30 VDC input sense (low or high true) selectable by command input for each axis.

User definable I/O

Up to 16 bits of user definable digital I/O. The 16 bits are user configurable and are configured as 8 inputs and 8 outputs as defaults from the factory. NOTE: 6 general purpose inputs are shared with two auxiliary encoder channels.

Analog inputs

Six independent analog inputs, 16 Bit resolution

Analog outputs (servo)

+/-10V and 0 to +10V, max. One per axis plus two general purposes.

Step pulse output

Pulse width 50% duty cycle. Open collector level signal (TTL).

Direction output

Open collector level signal (TTL).

Encoder feedback

Maximum 16 MHz after 4x quadrature detection. Differential signal.

Reference

VME64bus Specification ISO/IEC 15776:2001(E)
VME64x Specification ANSI/VITA 1.1-1997

Software

High level expertise not required.
Over 250 ASCII character commands, expanded from current OMS command set.

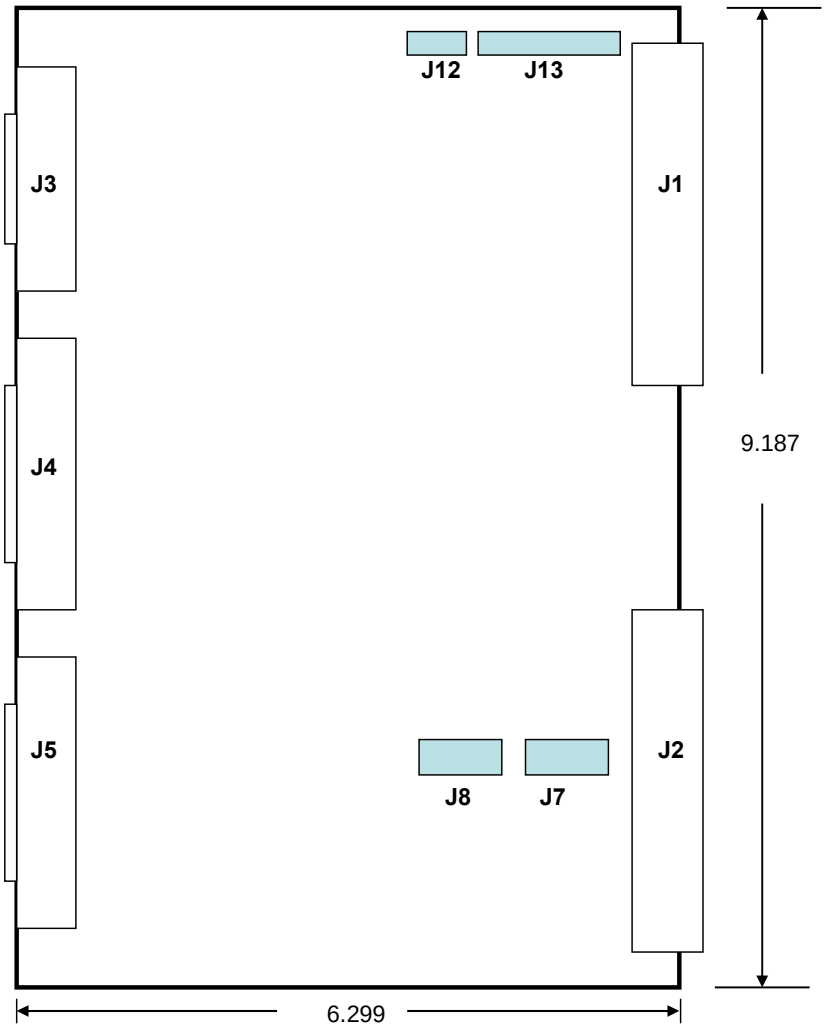
"The Company in Motion"

J12 = IRQ and Address Mode

J13 = Address and Address Modifier

J7 = P2 I/O or Analog Selection

J8 = P2 Step or Servo Selection



Ordering Information	
Model	No. of Axes
MAXv-1000	1
MAXv-2000	2
MAXv-3000	3
MAXv-4000	4
MAXv-5000	5
MAXv-6000	6
MAXv-7000	7
MAXv-8000	8

ACCESSORIES	
IOvMAX	I/O Breakout Board for MAXv
CBL50-10	I/O cable for MAXv to IOvMAX, 10ft
CBL68-10	MAXv to IOvMAX control cable, 10ft

3701-2700000
Revision C