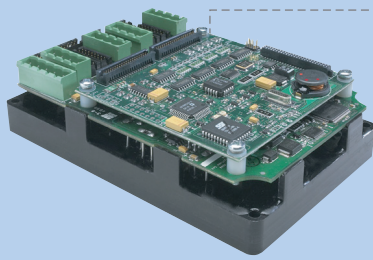


Performance and flexibility  
for demanding motion control applications



**MAX3000™**

## **MAX3000™**

**Performance and flexibility for demanding motion control applications.**

The MAX 3000™ integrates multi axis motion control technology with high performance servo/stepper amplifiers.

The MAX 3000™ wraps a high performance Digital Signal Processing engine around Agile Systems core digital power block technology and a high-speed digital network. This provides a compact distributed motion control solution.

### **Key Features**

- ❖ 2-4 axes of high performance digital signal processing based control and digital power block technology
- ❖ Supports: FireWire B®, Ethernet, RS232/485/422
- ❖ Commutation – Sinusoidal
- ❖ Trajectory Profiles – S-curve and trapezoidal
- ❖ Performance Options – PVT, PT set-point streaming, PTP
- ❖ Motors supported – Brushed, Brushless, stepper and Voice coil motors
- ❖ Encoder support – quadrature, serial encoders
- ❖ Amplifier – 1 to 15 amps, 90 VDC
- ❖ Opto Inputs 4-16
- ❖ Differential Inputs 2-4
- ❖ Analog Inputs 2-4
- ❖ Opto Outputs 2-4

### **Product Benefits**

- ❖ Up to 50% reduction of cabling increase reliability
- ❖ On-board programming [off-loads host processing]
- ❖ Compact design [eliminates costly external panel]
- ❖ Advanced PID loop [increased performance]
- ❖ Common interface for various motor types

## Typical Applications

### Introduction

The MAX3000™ enables machine designs and automation systems to stand out in the market by maximizing performance and reliability while minimizing space and cost.

### Applications

- ❖ Industrial Robotics
- ❖ Equipment
- ❖ Printed Circuit Board Assembly
- ❖ Lab Automation
- ❖ Semiconductor Process Tools
- ❖ Semi Fab Automation
- ❖ Packaging Equipment

### Verticals

- ❖ Life Science
- ❖ Semiconductor
- ❖ Automation
- ❖ Photonics
- ❖ Automotive

### Pick and Place Head

Pick and Place Heads are a key component of PCB assembly equipment, placing the electronic components on the PCB with speed and accuracy. Size and weight of the head are major restrictions on the machine's throughput. To achieve the highest throughput, it is desirable to have more placement nozzles on the head. However, the more nozzles used, the more wiring for encoders, motor power and I/O are needed. The cable harness adds significant weight to the head assembly, reducing potential performance. The cable harness that is moving on the head assembly is also costly, a point of failure and decreases the reliability.

The compact size and light weight of the digital power MAX3000™ platform allows the entire motion control and I/O system to be mounted directly on the head, significantly reducing cabling. The MAX3000™ has proven capable of achieving the very fast move sequences and I/O events required to perform high speed chip mounter operations.

### Semi Wafer Handling Robotics

The 300mm semiconductor wafers transferred by the wafer handling robots can be many times the cost of the robot itself. Reliability is critical and smooth motion performance is necessary to ensure the safe handling of the payload with maximum throughput. The MAX3000™ platform integrates brushless servo amplifiers with the position/velocity controller, minimizing separate points of failure and consolidating the electromechanical system. External control boxes can be eliminated, reducing cabling complexity and minimizing the costly fab footprint where space is at a premium.

### Direct Drive Motor Control

Direct drive motor systems can achieve better accuracy and better servo performance than conventional motor systems. With the use of direct drive motors, backlash from belts or gearboxes are eliminated, increasing accuracy and repeatability. With backlash eliminated from the mechanical transmission there is nothing to limit servo gains from achieving maximum stiffness.

Direct drive motors are matched with a high resolution encoder, since there is no gear increase. High torque direct drive motors also need a high bandwidth controller/amplifier as there is no transmission to help absorb the varying load.

The MAX3000™ was designed with direct drive technology in mind: a combination of high bandwidth electronics for high resolution encoders and a robust compensator for increase system performance.

The compact size of today's direct drive motors goes hand in hand with the compact size and capabilities of the MAX3000™ platform.

# Software

## Introduction

Agile provides software tools for programming and configuring the MAX 3000™ controllers.

## DP•Win™

A Windows 2000/XP application that was designed to assist the user in tuning, configuring and programming the controller. Both DP Win™ and MAXLib™ commands are sent to the controller via high speed network interfaces Firewire Ethernet or the RS-232/485/422 port.

DP•Win™ is a graphical environment which is universal across Agile Systems digital power products. The following list describes the key features:

- > Quickly set up, tune and program the controller
- > An oscilloscope tool to datalog system registers in real time
- > Auto-calculates the optimum current loop settings which allows the use of any motor type
- > Stimulus Tools to perform cyclic motion to exercise the axes
- > Advanced filter toolkit
- > View and set inputs and outputs
- > Frequency analysis toolkit
- > Programming editor
- > Motor Verification Tool

A comprehensive overview of DP•Win™ can be found in the DP•Win™ datasheet or in the DP•Win™ Help System.

## MAXLib™

An ANSI C library that creates the necessary packets to access the functionality on the controller.

MAXLib™ is an ANSI C library that provides the user with a flexible and complete interface to the MAX family. MAXLib™ includes functions for relative and absolute moves, PVT, PV, I/O control, scanned and timed events, program flow and conditional events. MAXLib™ is a thread-safe library that supports C and C++ users on any hardware target for which an ANSI C compiler exists. An overview of MAXLib™ including a complete list of functions and registers can be found in the DP•Win™ help system.

## Command Interface

A detailed specification on how to create the packets to access the functionality on the controller is available to programmers who need to create their own library in any programming language.

## Compensators

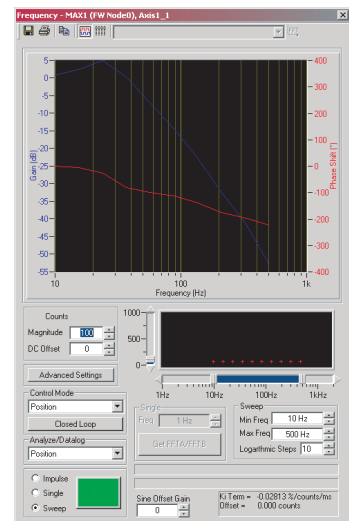
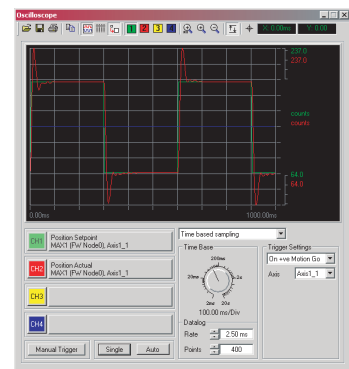
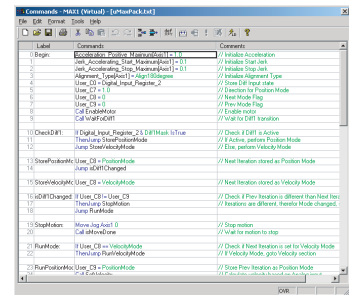
Position loops sampled at 4kHz use PID and IIR filter compensation in conjunction with velocity, acceleration, and jerk feedforward. The result is very high dynamic stiffness and virtual elimination of tracking errors, even in systems with large inertial mismatch between motor and load. Current loops are sampled at 20kHz on the Digital Power Block

## Application Software

- ❖ DP•Win™ tuning tools with graphical analysis, data logging, frequency analysis and programming

## Software Support

- ❖ Command Interface - Published Controller Specification
- ❖ MAXLib™ – OS independent ANSI C Library for accessing controller functionality



# Product Specifications

## Product Specification

Product	Max3020	Max3030	Max3040
Part Number	10-302X-XX00	10-303X-XXX0	10-304X-XXXX
Amplifiers	2	3	4
Amplifier Options	1A, 3A, 5A, 15A(Peak)	1A, 3A, 5A, 15A(Peak)	1A, 3A, 5A, 15A(Peak)
Motor Voltage	90VMax	90VMax	90VMax
Logic Voltage	12V Min-15V Max	12V Min-15V Max	12V Min-15 V Max
Network	Serial (RS232/485/422) Firewire B CAT5 Ethernet	Serial (RS232/485/422) Firewire B CAT5 Ethernet	Serial (RS232/485/422) Firewire B CAT5 Ethernet

## General Specifications

Type	Servo/Stepper
Variants	864
Design Modularity	24 nodes / Port or Stand alone
Feature Flexibility	Some Flexibility in new features
Serviceability	Multi Axis Design
Number Of Axis	4, 3, 2

## Memory/Programming

Memory Capability	Parameters and user Programs
User Processing	User Logic [2000 Lines]
Programming Options	ANSI C/C++ – OS independent Stand Alone (Agile Language)
Application Software	DP•Win™
Host Library	MAXCLib™
Event Response Mechanism	Yes

## Networking/Architecture

Architecture Options	Host driven (distributed) Stand alone Pulse and Direction
Peer to peer networking	No
Network Types	RS232 RS485 RS422 Firewire B CAT5 TCP/IP Ethernet
Theoretical Network Bandwidth	RS232 115.2 kbps RS485 921.6 kbps Firewire 100 Mbps
Real Network Bandwidth (Windows)	Ethernet 921.6 kbps RS232 100 kbps Firewire 2 Mbps Ethernet 120 kbps

## User Inputs/Outputs

Opto Inputs	4-16
Differential Inputs	2-4
Analog Inputs	2-4
Opto Outputs	2-4
High Current Outputs	2-4
Input position latch	High speed

## Amplifier Options

Voltage	1-90V
Peak Current	1A 3A 5A 15A

## Encoder

Encoder support	Incremental (Single ended) Incremental (Differential) Serial Absolute
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## Motor

Commutation Options	Trapezoidal Sinusoidal Trapezoidal startup, Sinusoidal Run Time
Motor types	Brushed Brushless Stepper Voice coil

# Network I/O

## Introduction

The digitalPOWER™ MAX3000™ platform has the flexibility to communicate over multiple networks:

- ❖ Firewire B CAT5
- ❖ TCP/IP Ethernet
- ❖ RS-422
- ❖ RS-485
- ❖ RS-232

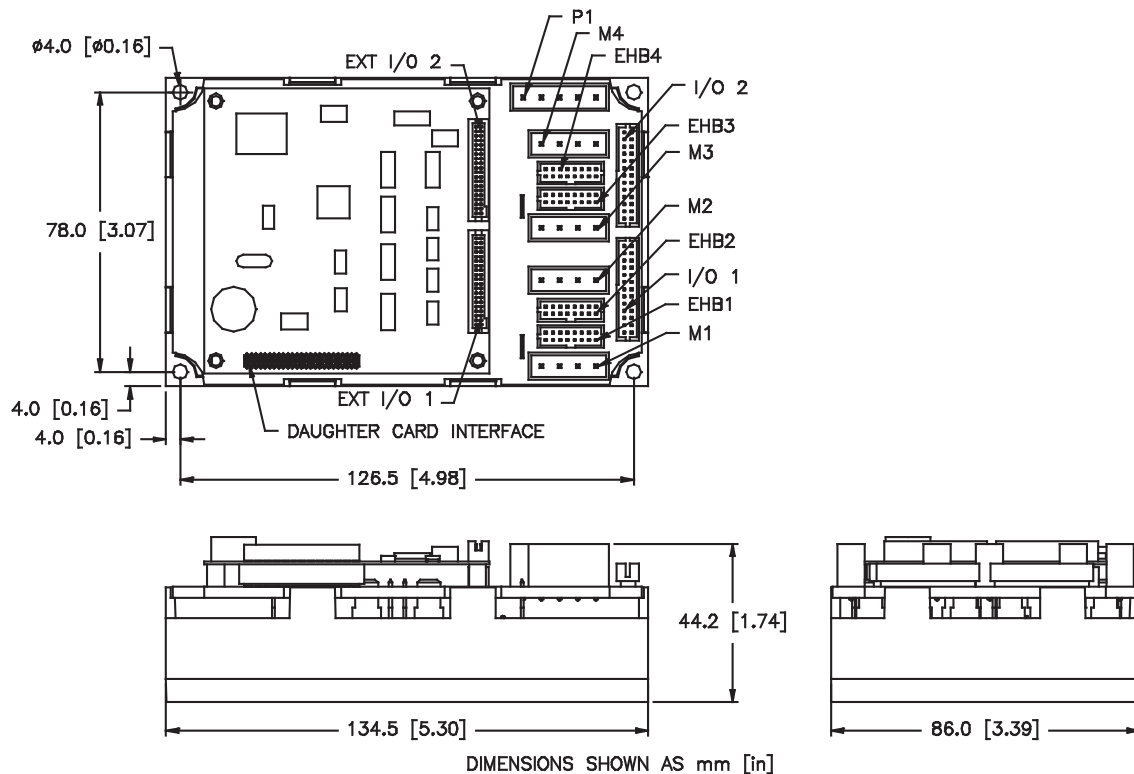
Network	Bandwidth	Overview
Firewire B CAT5	100Mbit/s	Allows high resolution PVT streaming with inter-axis synchronization 1 microsecond with 2 ms setpoints
RS-485	921.6 KBps	High speed, deterministic RS-485
RS-232/ RS-422	115k KBps 921.6 KBps	Standard RS-232 for universal applications differential line drivers
TCP/IP	921.6 KBps	

The MAX3000™ has built-in support for RS-232 and multidrop RS-485 /422 while the Firewire and Ethernet networks use a low profile daughtercard for their communication interface.

The daughtercard also includes an expansion of 24 opto-isolated user I/O (12 in/12 out).

Performance depends on the network choice; the MAX3000™ platform accomodates the range of simple, cost-conscious motion with RS-232/485/422 and Ethernet to high performance, synchronized motion over multiple MAX3000™ modules with Firewire B CAT5

## MAX3000™ Mechanical Drawing



## Connector Pinouts

### I/O Connector (IO-2)

2 x 13 Molex (2mm) 87331-2620

Pin Number	Function
1	+ Differential Input 1
2	+ Analog Input 1
3	- Differential Input 1
4	- Analog Input 1
5	+ Differential Input 2
6	Digital Ground
7	- Differential Input 2
8	+ Analog Input 2
9	+ Differential Input 3
10	- Analog Input 2
11	- Differential Input 3
12	Digital Ground
13	+ Differential Input 4/ +RS422 (RX)
14	+ Analog Input 3
15	- Differential Input 4/ -RS422 (RX)
16	- Analog Input 3
17	RS232 Transmit
18	Digital Ground
19	RS232 Receive
20	+ Analog Input 4
21	+ RS485/ RS422 (RX)
22	- Analog Input 4
23	- RS485/ RS422 (RX)
24	Digital Ground
25	Logic Voltage*
26	Logic Voltage*

### Encoder (EHB1,EHB2,EHB3,EHB4)

Mating Connector:  
2 x 8 Molex (2mm) 87331-162

Pin Number	Function
1	Encoder 5V Supply
2	Encoder A+
3	Encoder A-
4	Digital Ground
5	Encoder B+
6	Encoder B-
7	Do Not Connect
8	Encoder Index +
9	Encoder Index -
10	Logic Voltage*
11	Brake
12	Digital Ground
13	Hall Sensor Phase A
14	Hall Sensor Phase B
15	Hall Sensor 5 Volt Supply
16	Hall Sensor Phase C

### I/O Connector (IO-1)

Mating Connector:  
2 x 13 Molex (2mm) 87331-2620

Pin Number	Function
1	Opto Isolated Input 1
2	Opto Isolated Input 9
3	Opto Isolated Input 2
4	Opto Isolated Input 10
5	Opto Isolated Input 3
6	Opto Isolated Input 11
7	Opto Isolated Input 4
8	Opto Isolated Input 12
9	Opto Isolated Input Common 1-8 Return
10	Opto Isolated Input Common 9-16 Return
11	Opto Isolated Input 5
12	Opto Isolated Input 13
13	Opto Isolated Input 6
14	Opto Isolated Input 14
15	Opto Isolated Input 7
16	Opto Isolated Input 15
17	Opto Isolated Input 8
18	Opto Isolated Input 16
19	Opto Isolated Input 1-8 Return
20	Opto Isolated Input 9-16 Return
21	Opto Isolated Output 1
22	Opto Isolated Output 2
23	Opto Isolated Output 3
24	Opto Isolated Output 4
25	Do Not Connect
26	Opto Isolated Output 1-4 Return

### Motor Power (M1, M2, M3,M4)

Phoenix (5.08mm) MSTBVA 2,5/4-G-5,08  
Mating Connector:

Pin Number	Function
1	Shield
2	Motor Phase A
3	Motor Phase B
4	Motor Phase C

### Power Connector (P1)

Phoenix (5.08mm) MSTBVA 2,5/5-G-5,08  
Mating Connector:

Pin Number	Function
1	Shield
2	Logic Ground
3	Logic Voltage
4	Motor Ground
5	Motor Voltage

### Accessories

Accessory	Description
MAXCLib	ANSI C programming library
DP•Win	Configuration, programming, tuning and debugging tool
Developer's kit	Software, connector and cable kit.

## About Agile Systems

Agile Systems is a world leader in the design, development and manufacturing of advanced motion control technology including motor control and power conversion. Our team is highly skilled in integrating power electronics, digital controls and network communications into small, compact and cost effective packages.



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