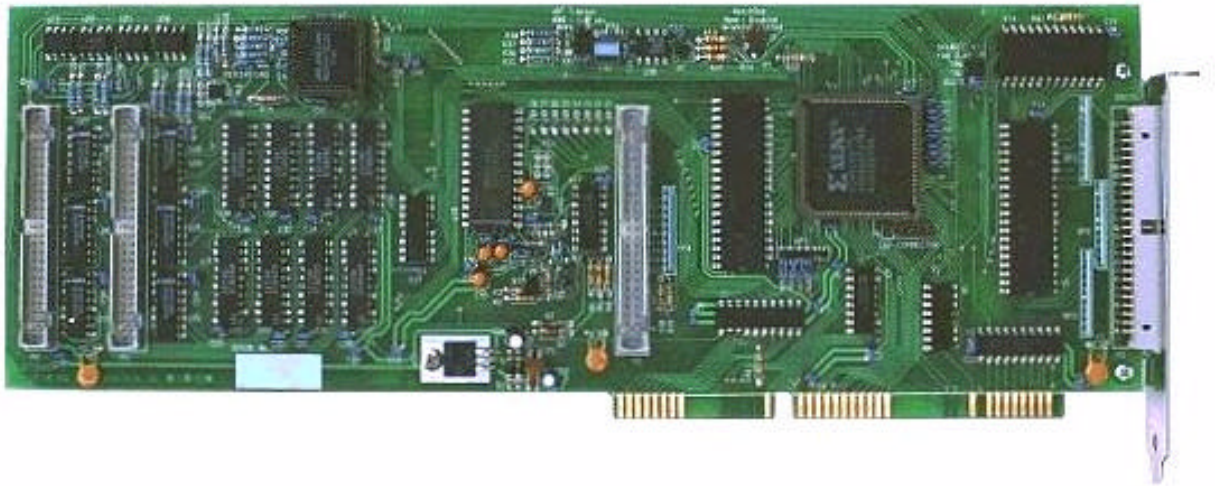
The Servo To Go

ISA Bus Servo I/O Card

Product Description



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Brief Hardware Technical Specification

The Servo To Go ISA Bus Servo I/O card is a low cost, general purpose, motion control input and output board which can control up to eight motors simultaneously from an ISA-bus based computer such as an IBM compatible PC. The following is a summary of the hardware functionality:

- **Encoder Input**
  - Up to 8 channels of quadrature encoder input, with index pulse
  - 24 bit counters, expandable to 32 bits or more via software
  - Single-ended or differential (RS422 compatible) input signals
- **Analog Output**
  - Up to 8 channels of analog output
  - + 10 V to - 10 V span.
  - 13 bit resolution
- **Digital Input and Output**
  - 32 bits, configurable in various input and output combinations
  - Connector is compatible with Opto-22 boards
- **Analog Input**
  - 8 channels of analog input
  - 13 bit resolution
  - Configurable as +/-10V or +/-5V spans.
- **Interval Timers**
  - Capable of interrupting the PC
  - Timer interval is programmable to 10 minutes in 25 microsecond increments
  - One general purpose time available.
- **Battery Backup Input**
  - Can maintain encoder counts in the event of a power failure.
- **Board Address Detection with IRQ software selectable**
  - Used to determine the board base address automatically without user interaction
  - IRQ number is software selectable - no board jumper required.
- **Watchdog timer**

Potential Applications Include:

Robotics

Machine tools

Motion picture camera control

Specialty machine control

Controls design and controls education

Automated test equipment

Medical instrumentation

Virtual reality “rides”

Motion Capture

Coordinate Measuring Machines (CMM)

General purpose, motion related I/O

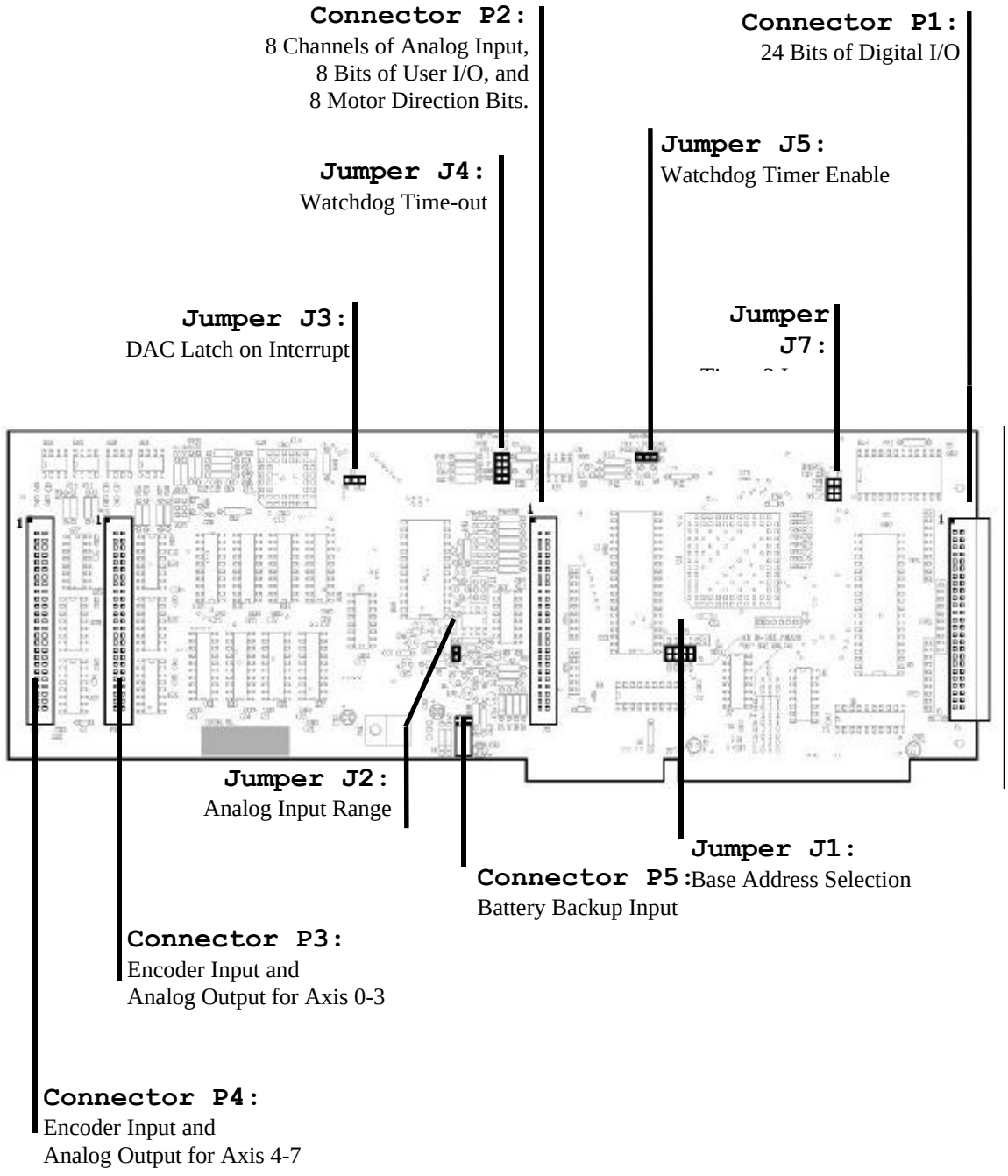
Although the board is typically used to perform servo motor control, it can also be used in other types of I/O applications. For example, in encoder position monitoring or any other application where encoder input as well as analog and digital I/O are required.

Additional Technical Specifications

The board is accessed by a set of registers located in the I/O space of the PC. The board is full-length in size. Connection to the outside is accomplished through the following five ribbon cable connectors:

Connector Name	Pin Count	Description
P1	50	An Opto-22 compatible connector containing 24 bits of digital I/O.
P2	50	Another Opto-22 connector containing 8 bits of user I/O, 8 motor direction bits, for a total of 16 Opto-22 compatible bits, plus 8 channels of analog input.
P3	50	4 Channels of quadrature encoder input and analog output
P4	50	4 Channels of quadrature encoder input and analog output
P5	2	Optional auxiliary battery input. Maintains encoder counting capability through a power failure.

Jumper and connector locations



Available Software

Windows 95

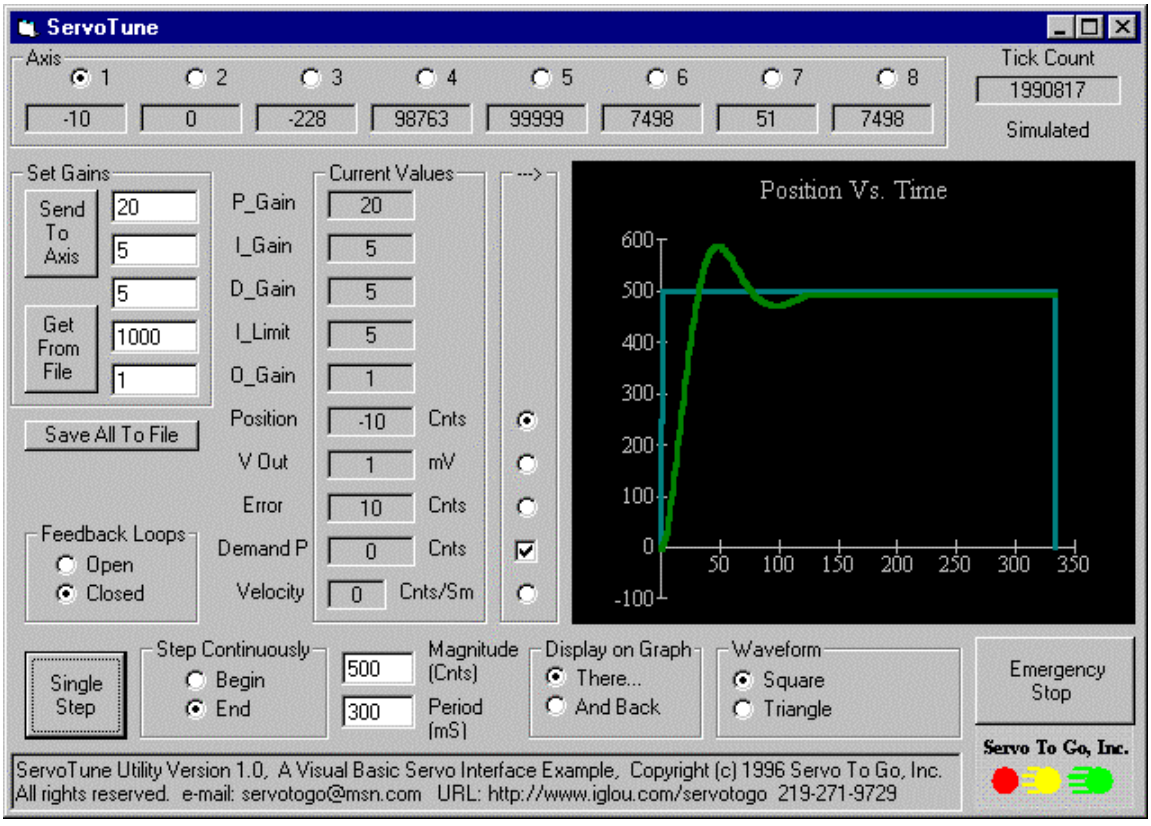
A Windows 95 virtual driver (VxD) has been developed for the board. This driver includes a PID control algorithm and allows users the ability to control up to eight axes of motion from C or Visual Basic under Windows 95 with a servo loop update rate of one millisecond. A graphical servo tuning utility available, as an example of using the driver with Visual Basic. The tuning utility lets users tune the gains of the servo algorithm by setting up either a square or sawtooth forcing function and observing the system response on a graph in real-time. A variety of variables can be graphed. The monitoring program lets users view, in real-time, various servo variables such as current error, or the status of the digital or analog inputs and outputs.

The VB utilities, Win95 driver, and the DLL are all available, free of charge, from our web site. Source code for the VB program is provided.

Accessing the driver from Visual Basic or C is easy. Over 40 commands are available to the user. Examples include: SET_POSITION, SET_P_GAIN, SET_VELOCITY, and GET_ENCODER.

Windows NT

A new Windows NT driver as been developed for the board. With this driver the servo algorithm as well as the DLL interface and the Visual Basic programs all function the same under Windows NT as Windows 95.



Screen of graphical PID tuning utility "vbtune.exe"

DOS

Source code for a simple MS DOS 'C++' language program that demonstrates how to access the board and perform I/O is available free of charge with a board purchase. The program exercises all the functionality of the board and includes a "dummy" interrupt service routine which users can modify to perform a servo algorithm.

This DOS software (executable and C source code) is also available free from our website.

A PC with a 486, 66MHz, or faster processor is required to use the software in most servo control applications.

Design Motivation

1. To Lower the Cost

Conventional eight axis motion control cards are expensive. To accomplish eight axes of motion control, many servo board suppliers require the purchase of a two board set. A single 4 axis servo board may cost more than $1,400.

The majority of this expense is in the on-board processor and dedicated servo integrated circuits used to perform motion control. Since the volume production of components for these boards is very much less relative to the volume production of components in, for example, the PC, their cost is more. Components which are also used in systems other than motion control have higher production volumes, so consequently, their cost is lower. Our approach is to use only very high production volume components, and use low volume components only if absolutely necessary.

Another problem for other servo board producers is that by using "on-board" processors the cost of hardware design and software development is much greater. For a relatively low volume product such as servo boards, this cost is spread across only a limited number of units, thereby significantly adding to the cost of each one. One way servo board manufactures try to get around this problem is by adding more functionality to the card to make it more "general purpose" and therefore able to reach a larger market. But this just adds unintended complexity and cost for functionality that the user is required to purchase but that is not really needed for most applications.

2. To Lower the Complexity

Almost all other servo boards contain a processor (DSP or other), and sometimes more than one. These processors perform the computations necessary to properly control a motor. The conventional thinking was that these on-board processors were necessary because the main CPU in the PC did not have the processing power required to perform the calculations in a reasonable amount of time. This was true in the past, but is no longer so, and if the trend toward faster processors continues, it will be even less true in the future.

Another argument for having an on-board processor is that, without it, a real-time operating system would be required on the main CPU, which would defeat a main purpose of using the PC in the first place. This requirement is also changing. Operating systems are providing an ever increasing amount of hard and soft real-time functionality, for example, preemptive multitasking, multimedia, and real-time game playing support. This recent OS functionality increase can be utilized for control applications. Another point is that an extremely fast servo loop update frequency may be necessary for some applications, but for many, an update rate of 1 millisecond is more than sufficient. These facts make an on-board processor unnecessary for most applications.

Complexity such as on-board multi-axis trajectory generators sometimes get in the way. This is especially true in many articulated OEM applications such as robotics and machine tool control, where a sophisticated trajectory is calculated by the OEM on the main CPU, and all that is required by the board is to move to various setpoints. Since functionality such as a trajectory generator is built-in and proprietary to competitor's cards, it is difficult or impossible to remove or modify it. With an open approach, such as with the Servo To Go board, this is not the case.

3. To Give Users More Control

Since the servo loop is calculated on-board conventional servo cards, it is a proprietary component of their system and cannot be changed. Users have no control over what control algorithm is used. Controls students can not experiment with the algorithm. An input/output only approach opens the system to other servo algorithms, controls experimentation, and even to applications which require plain, raw data I/O with no control algorithm at all.

Simply stated: We simplified the board, reduced the cost, and increased user control.

Servo To Go, Inc.

Product Configurations and Price List

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The standard configuration is the eight axis servo I/O card which also includes the following: 32 bits of digital I/O, a timer capable of interrupting the PC, and 8 channels of analog input, plus other functionality. An axis consists of one channel of encoder input and one channel of analog output. Each single board purchase includes a straightforward yet detailed manual and example software.

The following are single quantity prices. Delivery is one to two weeks, with faster delivery possible, depending on order size and available inventory. All prices are in US dollars. Visa, Mastercard and Discovery cards accepted for international orders.

Servo I/O card models:

8 Axis standard - Model designation: STGII-8	$888
6 Axis standard - Model designation: STGII-6	$848
4 Axis standard - Model designation: STGII-4	$808
2 Axis standard - Model designation: STGII-2	$768

On orders of 100 units, take 20% off the above hardware prices

We would like to make it as easy as possible for customers to fully utilize all aspects of our servo board product. Therefore, our Windows 95 VxD and our new Windows NT driver and the interface DLL and a substantial amount of example source code are free and can be downloaded from our web site with no purchase necessary. For users who need complete control over all the software in their application, we also offer our entire source code for a modest price.

Software:

DOS example executable and source code	Free
Windows 95 virtual driver (VxD) or Windows NT driver	Free
Visual Basic Servo Tune Utility including source code	Free
Source code license to the Windows 95 VxD, Windows NT driver and DLL	
For R&D or non-commercial purposes – Model DRVR-N	$500
For commercial use (not to be resold) – Model DRVR-S	$888
Unlimited use license (i.e. you can resell source code)	$6,000

Note: The Windows 95 and Windows NT driver source code was developed using Microsoft's Visual C++ 5.0, VtoolsD driver development toolkit was also used to develop the Windows 95 VxD. It may be necessary, depending on your application requirements, to purchase these tools in order to fully utilize the source code. The source code and documentation will be delivered on CD ROM. The unlimited use license is intended for manufacturers of similar I/O only servo boards who would like to jump-start their development effort or for OEM users of our board who anticipate purchasing a large quantity. Please call for more information.

Other quantity discounts and custom configurations are available - please contact the company for pricing and other information.