

Flextek Electronics Product Overview

Intro. Flexible Control System

Patent 6697685

Low-cost products for digital power control and automation are easy to use:

- Power Conversion and Process Control (FlexConverter™ Module has Automated Configuration)
- Embedded Real-Time Closed-Loop Control (CLOZD™ IC for Digital Control without Programming)
- PC-Based Automation (FlexController™ SOC is Commanded by FTview™ Active X)
- Isolated Multi-Drop Serial Bus (FlexBus™ Enhances COM or USB Operation)
- PIC Micro Development (MultiDriver™ Power Board with FlexBus™ and PIC ICD Interfaces)

Application notes with education kit and tutorial make it easy to quickly satisfy a broad range of requirements in power, thermal, motion, lighting, and flow. Expert service is available at reasonable rates for product customization or application design.

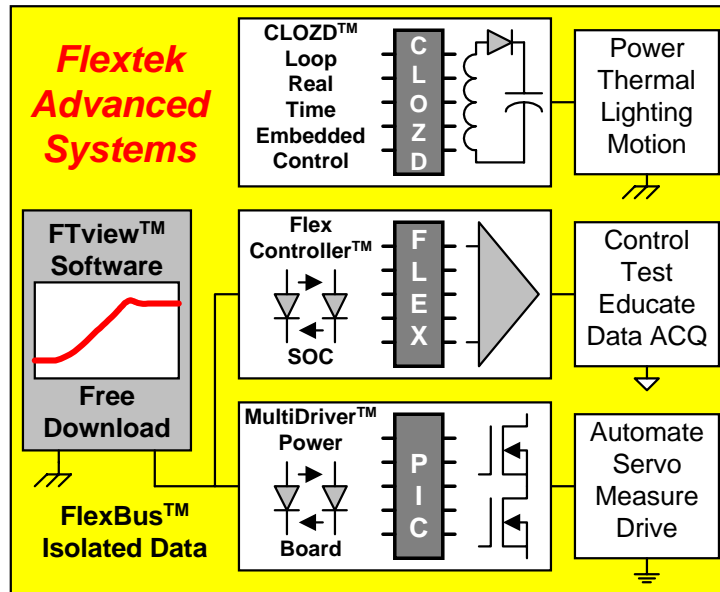


Figure I.1. Flextek Advanced System Diagram

Flexible products for easy and affordable control of power, thermal, motion, lighting, and flow applications, as well as general data acquisition. Control can be stand-alone with CLOZD™ Chip or PC interactive with FlexController™ SOC. The real-time CLOZD™ loop controller chip is quickly configured through pin settings to automatically adjust output drive until sensor feedback matches desired setpoint. The PC-based automation system is commanded through FTview™ Active X software that allows easy customization through Visual Basic. FlexBus™ provides isolated data communication and the MultiDriver™ Board adds a versatile power stage. Products are Microchip PIC and ICD compatible to facilitate custom development.

Flexible Controller Patent 6697685

Flextek Electronics has recognized that most control systems have the same basic elements, so flexible controllers with configurable elements have been created to satisfy a broad range of tasks quickly and easily. Customers save time and money by using the same components in a variety of applications. Parts not only cost less when purchased in volume, but development time is reduced by reapplying familiar technology, and reliability is increased by using proven components.

General Product Descriptions

Digital Power Kit:

Kit contains MultiDriver™ Power Board with FlexController™ SOC and PC data cable for quick setup of PC-based control system. A CLOZD™ chip is also included for embedded closed-loop control circuits. Together, these products enable a variety of digital power control applications..

Complete control system.

FlexConverter™ Power Module (Future Product):

Flexible power converter handles Point-Of-Load applications as well as challenging process controls. This patented product may be quickly configured as a programmable power supply, TEC thermal regulator, or DC motor controller. Configuration is accomplished through a PC GUI interface that also accepts Basic commands for ultimate customization. Operation can be stand-alone, processor controlled, or PC-based.

CLOZD™ Loop Controller Chip:

CLOZD™ is a patented control chip that is versatile and easy to use. Just select the desired timing configuration through pin settings and quickly close a loop around a power supply, motor drive, lamp, heater, fan, TEC, valve, actuator, or amplifier. Output drive is automatically adjusted until sensor signal matches commanded level, providing digital control without programming.

FlexController™ System-On-Chip:

Single chip solution opens a window to the outside world from your PC. A free Active X Control extends the advantages of simplistic Visual Basic programming to external devices, combining the useful peripherals of a microcontroller with the convenience of a PC. Powerful mixed-signal hardware with intuitive software enables easy control, automation, and data acquisition in power, thermal, motion, lighting, and flow applications.

FlexBus™ Isolated Multi-Drop Interface:

Connects up to four FlexController™ SOCs to PC for communication through each COM port or USB to Serial Converter (Full Speed). The electrical isolation of the data bus eliminates line drops and ground noise from measurements, protects the PC from power transients, and enables operation at voltages not possible with other systems. Interface board with controller socket (chip sold separately) may also be used with PIC micro (ICD compatible).

MultiDriver™ Power Board:

The versatile power, control, and data interfaces of the MultiDriver™ Board save valuable time by providing an integrated system for digital controller development. Circuit board combines FlexController™ SOC and FlexBus™ Interface with a power stage that accepts 12V to 48V and provides 6A half-bridge or 3A full-bridge output current. Power board with controller socket (chip sold separately) may also be used with PIC micro (ICD compatible).

FTview™ Software:

Free software written in Visual Basic demonstrates capabilities such as data acquisition, plotting, and logging through a GUI interface for communication with FlexController™. An Active X Control is provided to write custom programs for interactive control and recording. Free download includes FTVdemo sample application, FTview™ Active X Control, and FTedkit for Education Kit.

Flextek Education Kit:

Kit provides intuitive feel to closed-loop control while demonstrating Visual Basic programming, SPICE simulation, microcontroller familiarization, and general electronic principles. Everything needed to perform valuable experiments, including FlexController™ SOC, FlexBus™ Board, Demonstration Board, FTedkit software, PC Data Cable and Power Adapter.

Recommended for new customers.

Simple Closed-Loop Control
CLOZD™ Loop Controller Chip CLZD010
Protected by Patent 6697685

“Power Electronics” Article Feb. 2004 featured CLOZD™ as Digital Power Converter
“Nuts & Volts” Article Oct. 2004 illustrates “Digital Closed-Loop Control Without Programming”
“EDN” Design Idea as Triac Powered Lighting and Heating
“Electronic Design” Design Brief as Versatile Process Controller

Closed-loop controllers make automatic adjustments to maintain constant output despite varying conditions. Examples include supply voltage, fluid temperature, motor speed, and light intensity. These parameters would shift over time and load without consistent correction.

Microcontrollers executing firmware are replacing op-amps with feedback networks that used to perform closed-loop control. These digital implementations are versatile but time-consuming to program, and control demands often exceed processor resources. Considerable expertise is required to properly design a system to avoid oscillations or sluggish response. We naturally observe events in the time-domain while control analysis is typically done in the frequency-domain, which can be complex and confusing.

One solution to these challenges is an automated closed-loop controller configured by intuitive time-domain settings. CLOZD™ is a patented control chip developed by Flextek Electronics that is versatile and easy to use. Just select the desired timing configuration through pin settings and quickly close a loop around a power supply, motor drive, lamp, heater, fan, Peltier, valve, actuator, or amplifier.

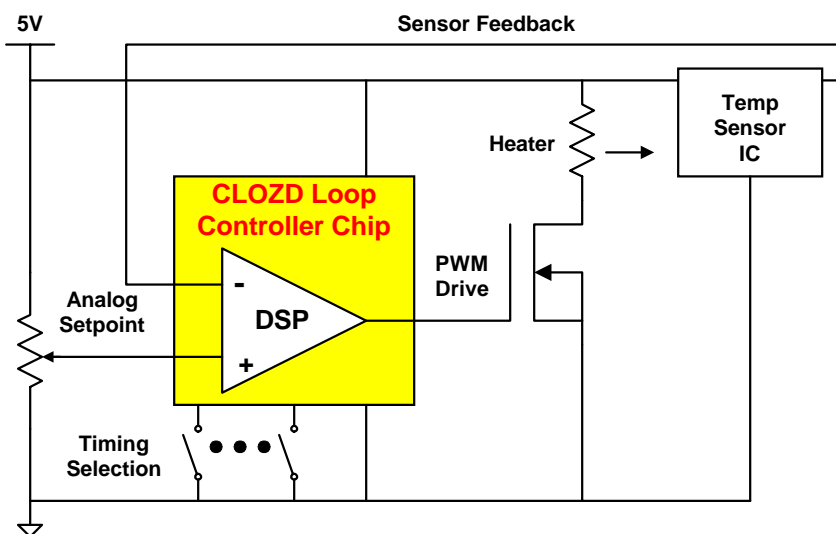


Figure I.2. CLOZD™ Loop Controller Thermal Example
(Chip may also be used for power, lighting, motion, and flow control.)

Controller drive is automatically adjusted until the measured sensor signal matches the desired command. The Digital-Signal-Processing (DSP) algorithms within the CLZD010 control chip compare the feedback sensor signal and the analog setpoint command to determine appropriate Pulse-Width-Modulator (PWM) drive for the plant.

Closed loop control may be the most common and yet the most challenging task in electronics. By automating this task with versatile interfaces that are easy to use, a wide range of custom applications are quickly satisfied. Typical plants include power, thermal, motion, lighting, and flow applications.

Easy PC-Based Control
 FTview™ Active X for Easy Control of FlexController™ SOC

Programming a microcontroller is time-consuming and tedious, but commanding FlexController™ SOC within the resource-rich environment of PC graphical development tools is quick and easy. Download the free FTview™ Active X software from www.flex-tek.com and install it on your Windows PC, then quickly generate custom applications in Visual Basic.

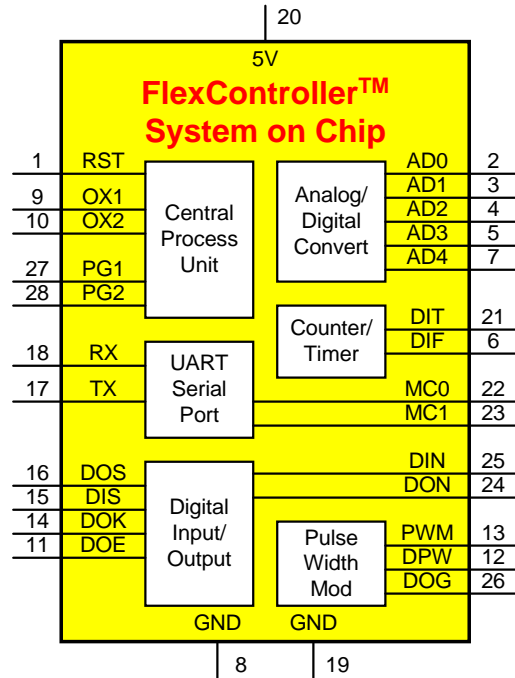
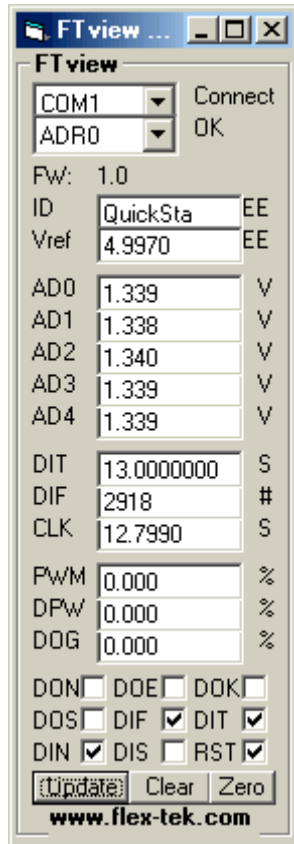


Figure I.3. FTview™ Active X provides Intuitive Interface to FlexController™ SOC

FlexController™ SOC combines the essential peripherals of a microcontroller (ADC, PWM, Timers, etc.) with the ease of Visual Basic (or C++) programming:

```

Private Sub FTview1_NewData()
    Thermal = 100 * FTview1.AD0volt
    RPM = 60 / FTview1.DITinterval
    FTview1.PWMduty = PIDout
    FTview1.UpdateCmd = True
    Write #1, Time, Thermal, RPM, PIDout
End Sub
  
```

- ' Executes when data ready
- ' Read AD0 voltage
- ' Read DIT timer
- ' Write PWM duty cycle
- ' Update Control SOC
- ' Save data to File

Chips may be purchased separately for high-volume cost-sensitive applications or with convenient development boards to save valuable time. The FTview™ software may be downloaded free with demonstration applications that illustrate data logging and closed-loop control.

Affordable Automation
 Digital Power Kit Application Example
 “Visual Basic for Low Cost Automation” Publication Pending

The electronics market has countless variations of data acquisition products, but these devices do no more than passive observation. Active PC-based control systems are highly desirable for automation but are often too expensive and time-consuming to learn. The essential elements for automation include an output power stage, isolated data interface, and custom programmability. Power is adjusted until the desired response is acquired over an interface that is isolated for safety and noise immunity. Since every system is different, it is critical that the controller be capable of custom configuration quickly and easily.

MultiDriver™ Board by Flextek contains a versatile power stage that can be configured as a high power full-bridge or half-bridge driver. Control and communication is accomplished with FlexController™ System-On-Chip that measures sensor response and issues power command. PC data communication is safely handled through the isolated multi-drop interface FlexBus™. The graphical user interface may be quickly customized for a variety of applications with the FTview™ Active X. Together, these elements make affordable PC-based automation that is easy to use.

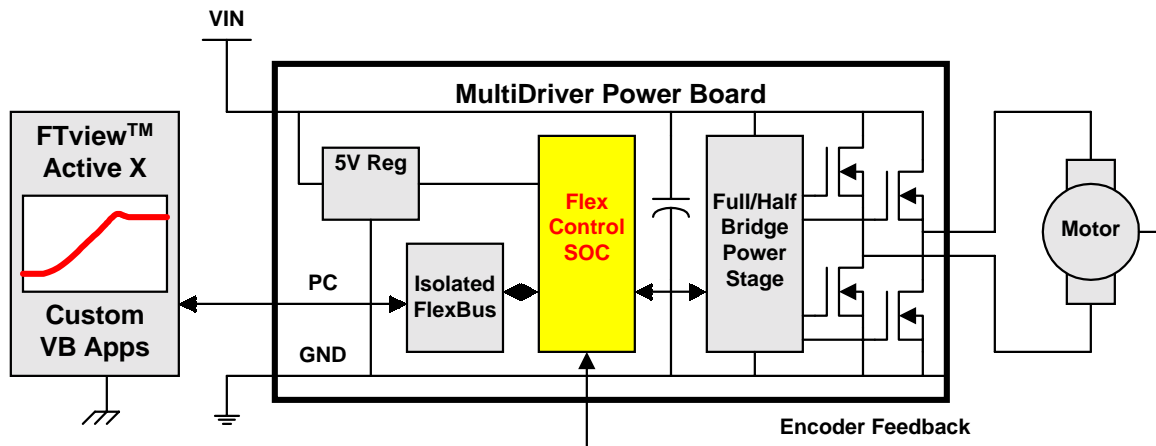


Figure I.4. MultiDriver™ Board with FlexController™ SOC in PC-Based Motor Control Example
 (System may also be used for power, thermal, lighting, and flow control.)

Data communication to FlexController™ SOC is through FlexBus™ isolated multi-drop serial bus that eliminates line drops and ground noise from measurements, provides protection from power transients, and enables operation at voltages not possible with other systems. The data bus is port-powered, addressable, and compatible with common USB to Serial Converters for maximum flexibility.

The versatile power, control, and data interfaces of the MultiDriver™ Board save valuable time by providing an integrated system for digital controller development. Typical applications include power, thermal, motion, lighting, and flow control for industrial and educational purposes. Flextek product manual provides application notes with schematics and code examples.

Products that Teach

Flextek Education Kit featured in "Electronic Design" Article Dec. 2003

The Flextek Education Kit is a low-cost system that provides an intuitive feel to closed-loop control while demonstrating Visual Basic programming, SPICE simulation, microcontroller familiarization, and general electronic principles.

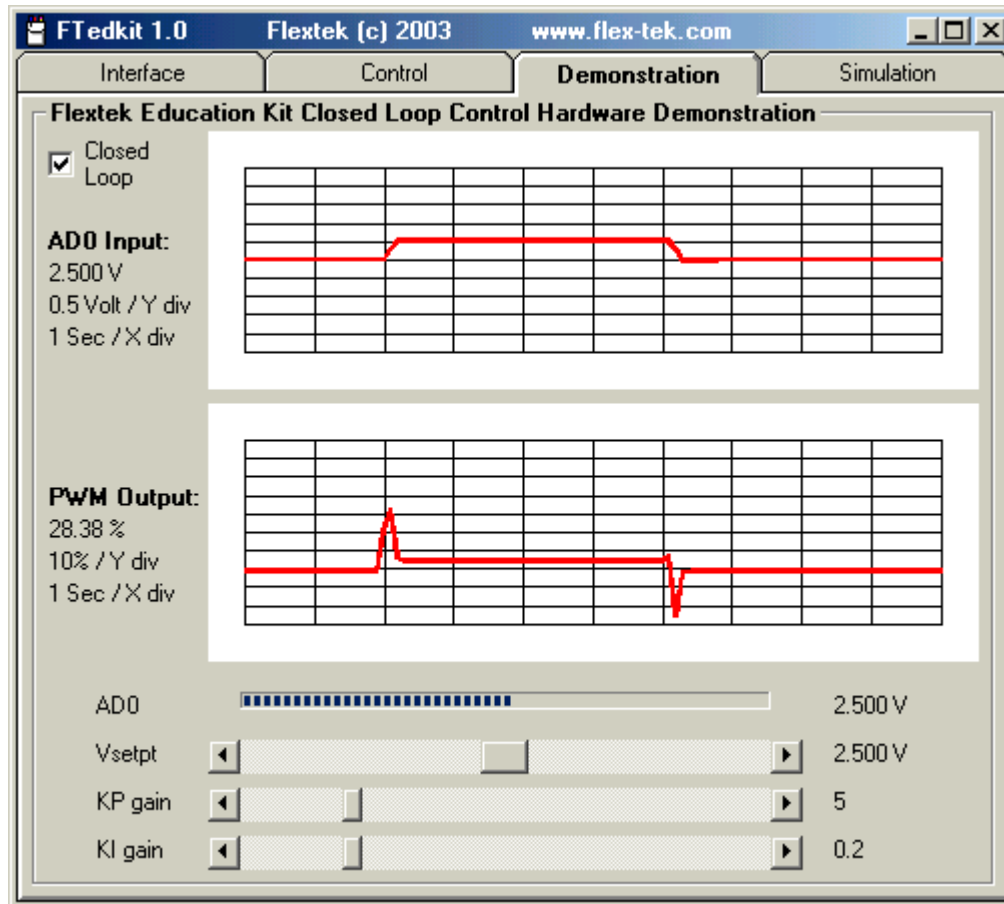


Figure I.5. FTedkit Software Illustrates VB Programming with FTview™ for Control

The following section of Visual Basic code executes PI closed-loop control:

```

Private Sub FTview1_NewData()
    AD0 = FTview1.AD0volt
    Verr = Vsetpt - AD0
    PropErr = Verr * KP
    IntSum = IntSum + Verr * KI
    PIout = PropErr + IntSum
    FTview1.PWMduty = PIout * 100/5
    FTview1.UpdateCmd = True
End Sub

```

- ' Executes automatically when data ready
- ' Read sensor ADC
- ' Determine error for PI calculation
- ' Calculate Proportional Error by KP gain
- ' Integrator running sum by KI gain
- ' PI is Proportional plus Integral terms
- ' PWM is PI scaled by PWM/ADC ranges
- ' Write data (NewData event when done)
- ' Sub loops at Update rate

The PI digital controller is converted to an equivalent analog SPICE model to enable simulation for increased understanding of the control algorithm.

Development Shortcuts

Flextek Products Employ Robust Design Techniques and Industry Compatible Interfaces
MultiDriver™ Power Board featured in “Power Electronics” Article Feb. 2004

Custom designs may be facilitated with Flextek products by starting with proven off-the-shelf parts. This process enables quick proof-of-concept demonstrations, and reduces overall development time by revealing system challenges early. FlexController™ SOC and MultiDriver™ Board quickly test algorithms written in FTview™ software prior to an otherwise lengthy design cycle.

Flextek products avoid countless hours of frustrating troubleshooting that plague most development efforts by employing robust design techniques:

- PC interface electrical isolation
- PCB ground plane with bypass capacitors and analog filters plus current limit resistors
- Power electronics current limit, thermal shutdown, and under-voltage lockout protection
- Processor watchdog timer and brownout detection
- Firmware real-time operating system with multi-tasking and prioritized interrupts
- Digital filters, event synchronization, checksums and error detection
- Expert engineering services

FlexController™ SOC is pin compatible with Microchip devices and Flextek boards contain connections for In-Circuit-Debugger 2. These design features enable users to add a versatile power stage or isolated interface to any PIC project with minimum effort and cost.

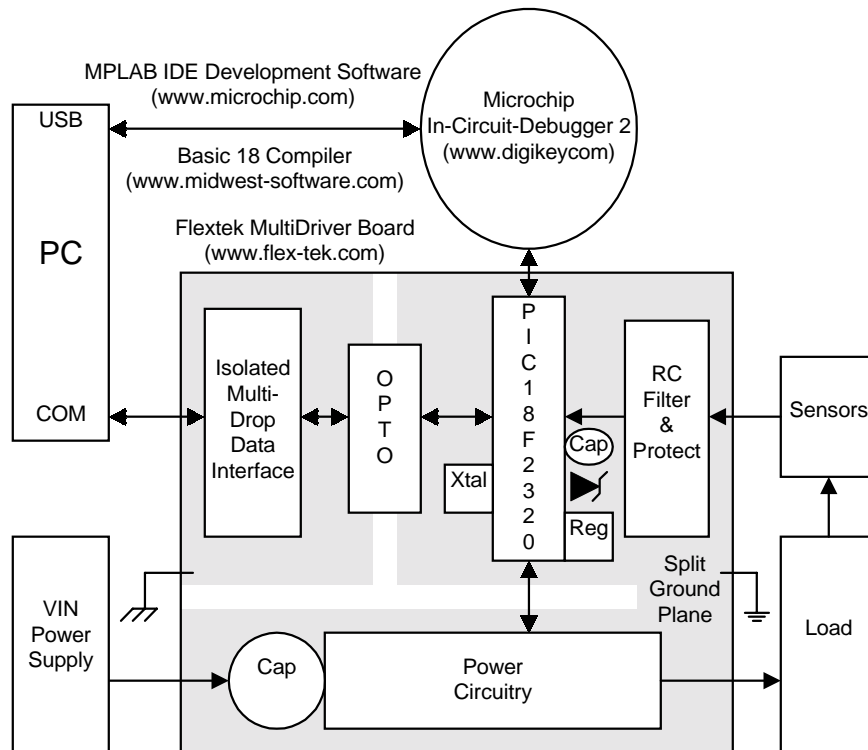


Figure I.6. Compatibility with Popular PIC Micros Quickens Customization Efforts

Flextek Electronics has a varied product line that demonstrates extensive expertise in power and control electronics, as well as software development. Product customization and application design services are available at reasonable rates to help customers satisfy challenging requirements.

Frequently Asked Questions

Q1. What is so unique about your patented CLOZD™ chip?

A1. Closed loop control may be the most common and yet the most challenging task in electronics. By automating this task with versatile interfaces that are easy to use, a wide range of custom applications are quickly satisfied. Robust operation is achieved through an advanced control algorithm that is easily configured for desired timing. Other methods and products require extensive programming and complex frequency-domain analysis. CLOZD™ is unique because it is so versatile and easy to use.

Q2. How is FlexController™ SOC different than a microcontroller?

A2. Both have peripherals for control applications, but FlexController™ has built-in functions that are quickly applied through Visual Basic. Microcontrollers require lengthy programming in assembly language to do even simple tasks. FlexController™ is designed for PC-based applications but it can also benefit microcontroller development by quickly testing algorithms in VB before committing to time consuming firmware coding.

Q3. Why would I want to use FlexBus™ rather than USB alone?

A3. FlexBus™ is optically isolated for safety and noise immunity that is essential in power control applications, while USB has bi-directional data lines with extreme timing requirements that are not easily isolated. FlexBus™ can be connected directly to the PC COM port or USB to Serial Converter (Full Speed) for isolation with up to four devices on each port. USB alone restricted to earth grounded data acquisition with short cables.

Q4. Why do I need your patented flexible control system?

A4. You save time and money by quickly configuring the same parts for multiple applications. This allows you to save on parts by purchasing in volume, reduce development time by reapplying familiar technology, and increase reliability by using proven components. Application-specific solutions are too rigid and design-from-scratch solutions are too time consuming.

Advantages

Flextek Advanced Systems	Leading Competitor
Real-time control and graphical programming	Real-time control and graphical programming
Low-cost control chips and boards	Expensive laboratory equipment
Free software	Thousands of dollars for software
Tens of dollars for hardware	Thousands of dollars for hardware
Volume production and industrial automation	Laboratory experimentation
Few components to satisfy countless tasks	Countless components to satisfy few tasks
Easy to learn in an afternoon	Challenging to learn in a month

Flextek Electronics continues to innovate and produce simple solutions to complex problems, so check our web site often at www.flex-tek.com and recommend it to associates or friends for technical tips and on-line sales. Please contact Flextek with ideas or suggestions.