APPLICATION NOTE

CAS DATALOGGERS

Event Triggered Control & Data Acquisition Using an ADwin

Real-Time DAQ Systems Enable High-Speed Process Monitoring

*Adapted from 'Event Triggered Data Acquisition with ADwin' by Doug Rathburn of Keithley Instruments, Inc.

In today's production environments, it is increasingly important to capture data coming from each process and exert some event triggered control over the process to maintain quality and efficiency. The data is often generated at asynchronous intervals making it difficult to capture the data and generate an appropriate feedback response in a pre-determined manner. ADwin is synonymous quality with high-speed real-time data acquisition and control making it perfect for these demanding situations.

An ADwin allows the user to capture important data, analyze said data (filter, FFT, DFT etc.) and respond with control actions in real-time eliminating the latency inherent to most PC based systems. ADwin accomplishes this by incorporating DSP processors in every system so they don't rely on PC processor that may already be bogged down. ADwin offers numerous models with varying input and output configurations making it easy to adapt to almost any application.

Test Description

For this particular application, ADwin monitors one of its analog input channels, waiting for a rising edge in the signal. Once this rising edge passes a predetermined threshold point, data acquisition begins and the data is stored in memory. Acquisition is not stopped until a falling edge is detected in the signal or until the memory is full. If the falling edge is detected or the memory limit is reached the DAQ transfers the data to a PC running TestPoint™ for further analysis. The ADwin will transfer the data out of its registers without slowing the ADwin processor, maintaining the real-time operation of the system.

The programming software for the ADwin family is ADbasic and together with the hardware you define integer and floating-point variables which are stored in registers that can be accessed while the ADwin is running. The I/O registers can be easily accessed by the most common testing applications such as TestPoint™, LabView™, MatLab, etc.

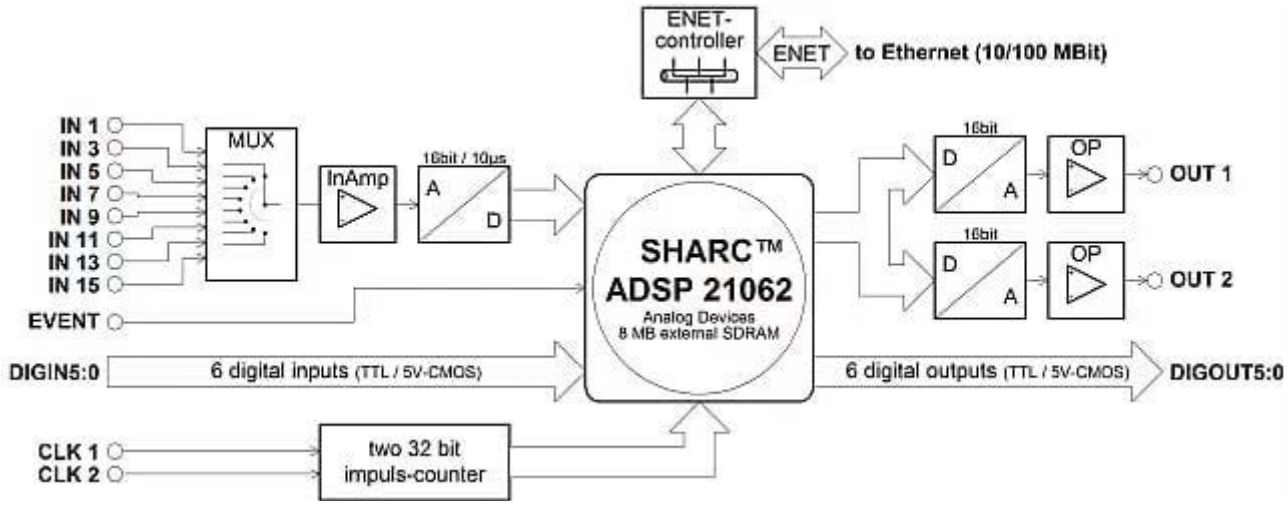
Methodology

The example provided in this application note illustrates a single-channel data acquisition system but ADwin systems are capable of much more. Table 1 lays out the channel and converter count of each model.

Table 1: ADwin Family Analog Input Selection

System	Analog input channels	Number of ADCs
ADwin-Light	8	1
ADwin-Gold	16	2
ADwin-Pro	Up to 480	Configurable

Data can be dynamically shared between the PC and ADwin as memory locations are updated and used 'on the fly,' which does not slow or interrupt the ADwin process while it runs. Variables can be defined for interchange as integers, floating-point numbers, or data arrays. The data is saved and updated in real time as the ADwin process is running, and, if the system updates one of the registers, the ADwin will use that new value during the next process execution.



All of the programs mentioned (TestPoint, Visual Basic, etc.) either have drivers or include files to communicate with the ADwin hardware, but TestPoint is the only program that supports the hardware interrupt from ADwin. When ADwin generates an interrupt (for example, executes the ACTIVATE_PC ADbasic command), the Action List of the ADwin Real-Time Object in TestPoint executes. If another programming environment is used, data can still be read and sent to the ADwin hardware, but ADwin cannot trigger an event to occur.

Data Interchange with FIFO Buffers

For applications with large amounts of data that must be continuously transferred to the host PC, ADwin allows the data structure to be configured as a FIFO (First-In, First-Out) buffer. The data that is stored in the FIFO is read in the same order in which it was stored. An example of a FIFO ADbasic program declaration is:

```
DIM DATA_1 [1000] AS INTEGER AS FIFO
```

This declaration defines an array with: the data set number 1, a length of 1000 integer values, and a FIFO ring buffer structure. The commands FIFO_EMPTY and FIFO_FULL are available in ADbasic to determine if there is still storage space available while the ADwin process is executing.

'On-the-Fly' Data Analysis

ADwin products are designed with their own microprocessors and memory, so they can perform analysis of measurement data before it is sent to the PC for display. If the digital signal processor (DSP) is chosen for the ADwin system, you can perform fast floating-point math operations that are useful for many filtering and Fourier transform operations.

Equipment List

PC running Windows 2000/XP/Vista/Win7 or Linux
ADwin real-time control hardware
ADbasic real-time development environment
Custom wiring harness for connecting to the test setup

Flexible Solutions

The ADwin product family offers many different form factors, processors, and I/O in which to create the PID controller. The ADwin family includes:

ADwin-Light-16 *PC ISA bus plug-in boards*

- Analog inputs and outputs (one 12-bit A/D)—expandable
- Digital I/O
- Optional counters and quadrature encoder
- ISA communication with the PC

ADwin-Gold *Stand-alone, external system*

- 16 analog inputs (16-bit @ 10ms & 12-bit @ 0.8ms)—BNC connections
- 2 analog outputs (16-bit)—expandable
- 32 digital I/Os, in blocks of 8 as input or output
- Optional counter (event counter, encoder interface, period cycle, PWM)
- ISA or USB communication with the PC

ADwin-PRO *Industrial, modular 19-inch system*

- Up to 4 CPUs per system
- Modular and expandable:
- 480 analog inputs (multiplexed or parallel)
- 120 analog outputs
- 480 digital I/Os
- Thermocouples, RTD, counter, filters, isolation, etc.
- CAN-bus, RS-232, RS-485, RS-422, Profibus
- ISA or USB for communication with the PC

Conclusion

ADwin data acquisition and control systems are ideal for operation in process monitoring and control applications. Available in several different models ADwin offers you high-speed precision and control for your manufacturing or other industrial processes.

For more information on ADwin Data Acquisition Systems, event triggered control or to find the ideal solution for your application-specific needs, contact a CAS DataLogger Application Specialist at **(800) 956-4437** or www.DataLoggerInc.com.