Low-Cost Solutions for Chip and Board Level

ADwin Real-Time Data Acquisition Systems

Depending on the complexity of analog and digital technology-based IC chips and electronic boards, there are different test solutions available for R&D and production line testing. While complex and expensive chips and boards are tested with large, sophisticated testers, more cost-effective test solutions are a necessity when testing low-cost chips and boards. A real-time system with a modular architecture such as the ADwin family of data acquisition devices makes an ideal and cost-effective platform to provide the necessary field tests of mixed signal testing for chips and boards. The ADwin system offers a selection of I/O cards including parallel analog I/O modules, parallel digital I/O modules, digital input modules with individual thresholds (comparator inputs), and large memory buffers for waveform storage, all with precise deterministic timing of all signals. Besides all these testing functions, the system can also be used as a FLASH programmer, providing the application with the high synergy of combining testing and programming in the same system.

Designing, prototyping, and testing systems such as mass-market IC chips and boards for electronic toys, inexpensive control units, washing machines, dishwashers, electronic tools, and many other applications requiring strong, integrated digital and analog data acquisition and signal generation hardware. The most efficient solution is to run all these functions on a single system—a system that provides users with a flexible selection of many different analog and digital I/O modules, a scalable system in number and type of I/Os, and synchronized functionalities with precise timing between all I/O modules. ADwin systems have all of these features and are characterized by deterministic execution of intelligent data acquisition and control applications. This is achieved through a local CPU (DSP) controller, the real-time heart of every ADwin system. The CPU is responsible for all real-time functions and guarantees a deterministic process execution entirely independent of the PC and its workload. ADwin systems work in close cooperation with PCs running Windows, but there is a clear job partitioning: the ADwin system's job is to execute fast and deterministic processes in real-time, while the PC performs standard functions such as graphical user interfaces for applications, visualization of data, and database accesses. ADwin systems add real-time capability to the PC, so if the Windows PC crashes, the ADwin system will continue to run, maintaining the integrity of the application.

These high-speed systems have a deep onboard memory and contain an Ethernet-based communication interface allowing multiple distributed test systems at a single PC or workstation and also feature excellent driver support for a single system running Windows, Linux, and Unix. The software allows the selection of the smallest ADwin system for applications with a very limited number of I/Os, while the code is compatible to applications with hundreds of I/Os using bigger ADwin systems. Additionally, FPGA-based modules provide nanosecond precision for customized functions in I/O modules, such as special hardware triggers or interfaces like SPI or I2C.

Key features of these chip and board testing applications include multi-channel arbitrary, analog and digital waveform generator, synchronized analog/digital stimulation of the Device Under Test (DUT), and measurement of the DUT responses with parallel, synchronized analog/digital inputs. Sequencing instructions are stored in a DSP with large memory and extremely fast real-time reaction time of 300 nanoseconds to control the complete system.

Synchronized analog/digital stimulation of the DUT is also possible. For high-speed arbitrary waveform generation and the stimulation of the DUT, the ADwin-Pro system provides multi-channel analog and digital output modules. The analog output modules have a parallel design, so that all channels can be updated synchronously without any phase shift between the channels. Parallel updating is a great advantage, especially if these signals need to be correlated to each other for the application. This update technique is achieved by using one DAC per channel, with one register per DAC. Therefore it's possible to first write new values to the control registers for all channels and then start the conversion for all channels with a single command.

Using a single module, 4 or 8 channels are available. If an application needs more channels, additional modules can be used simultaneously. Here too, all channels on several modules convert synchronously through one single instruction. Depending on the application, the update rates for the stimulation are in the range of kHz up to MHz.

A local RAM buffer on the I/O modules allows storage of waveforms. The allocation of this local RAM can be done freely, so it's possible to store multiple wave forms of different sizes, or a single large waveform. Each output can be linked to any waveform in the buffer, and each output can have its individual output rate. It's important to note that it's possible to perform the waveform generation in an adaptive way, so that (based on responses at analog/digital input signals or counter/timer values) the output can be modified within microseconds.

The ADwin-Pro's parallel analog measurement modules acquire all channels synchronously, without any phase shift between the measurement channels. Parallel sampling is a great advantage if measurement signals are correlated to each other. This measurement technique is achieved by using one ADC per channel. If an application needs more channels, more modules can be used simultaneously. As above, all channels on several modules convert synchronously through one single instruction with the values of all channels being processed online in the same sampling step. Modules with 4 and 8 channels are available, and again, if an application needs more channels, they system can simply use more modules simultaneously.

Internal RAM on each module is available as a memory buffer for measurement data. With this architecture, users will find it's possible to acquire the values of all channels with up to MHz sample rates. The RAM buffer can be used, but it is always possible to read single values directly and to build a real-time intelligent software trigger in order to run the DUT arbitrary waveform generation in an adaptive mode.

New digital and analog I/O modules for the ADwin-Pro-II system are equipped with a programmable onboard TICO CPU that

offers the development of application-specific functions running at MHz speed. Functions not available on standard I/O modules can be included via TICO code on these modules, so it is possible to run the following: sequence controlling, high speed application-specific counters, custom serial interfaces like SPI, Manchester-Code, I2C, etc. Also available is an equivalent analog input module with up to eight ADCs, an FPGA, and RAM. These modules are the base for extremely fast programmable customer-specific functions for pre-processing of the analog signals. The major advantage is the speed of TICO-based solutions; the routines generated for these digital and analog boards are run with nanosecond-level timing precision. Additionally, ADwin systems in general are very precise. In the standard configuration, the ADwin CPU reacts on any event within 300ns if it comes from a timer, a digital, or other event sources, allowing code to run on a standard ADwin system with cycle times of microseconds.

In addition to the CPU, there is a large local memory area for program code and measurement data. The communication between the ADwin system and the PC is via Ethernet or USB. Fieldbus interfaces allow the connection to PLCs while a bootloader supports complete stand-alone operations of the ADwin system. Additionally, drivers are available for a wide range of PC programs under the Windows, Linux or MAC operating systems. Programming tools for the ADwin system include ADbasic or Matlab®/Simulink®.

For further information on ADwin data acquisition systems, or to find the ideal solution for your application specific needs, contact a CAS Data Logger Applications Specialist at (800) 956-4437 or visit our website at www.DataLoggerInc.com.