Serve CAN, LIN, SPI .. Interfaces in Real-Time

In many test applications, serial digital interfaces like CAN, LIN, SPI, RS-xxx, etc. must often be served in Real-Time: Reading from interfaces, perfoms any Real-Time online calculation in some microseconds, and writes to other interface lines. In combination with CAN and serial interfaces, signals from analog, digital lines or counters and encoders can be measured synchronized in the application. It is easily possible to run between 1 ... 30 serial digital and CAN interfaces in a single ADwin system, and serve all interfaces with high speed. Build up a mixed signal data acquisition, or system stimulation, or intelligent gateway, or switching matrix for serial signals, etc. With these possibilities, ADwin Real-Time systems allow efficient tests for CAN-based devices such as sensors, actuators, ECUs – electronic control units, and many more.

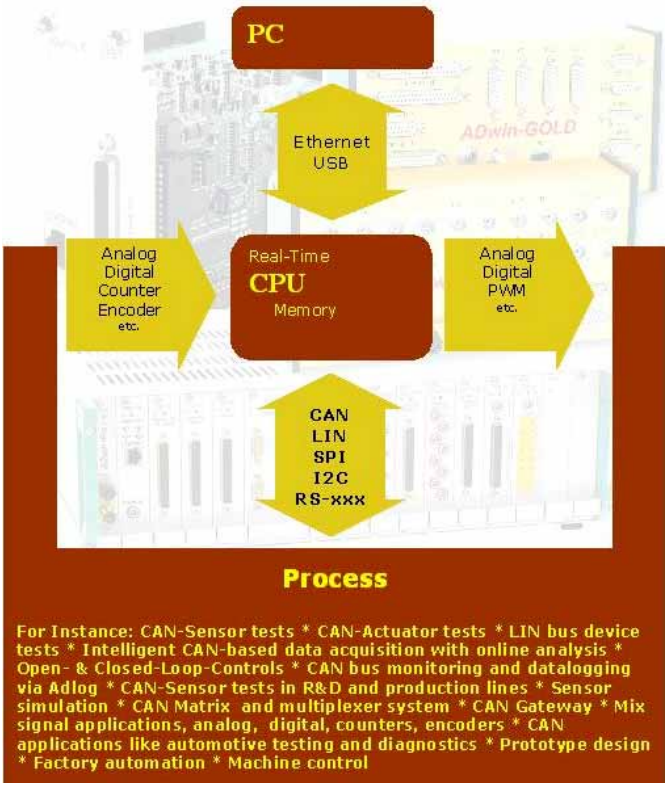
Recent developments in automotive test applications have demanded tighter integration of the CAN bus and other measurement devices. In many applications, engineers need to measure physical parameters - represented as analog, digital, counter, or encoder-based signals - synchronized with correlated messages on the CAN bus or other digital serial busses. Because of the high correlation of these signals, latencies and delays are not acceptable in most test applications, therefore the ***ADwin*** Real-Time system is the best solution. It is possible to run any online calculation or control in Real-Time, with NO latency of the PC operating system while the determinism of the application is guaranteed.

The heart of every ***ADwin*** system is a fast processor, a 32-bit floating point signal processor (DSP) and a huge local memory. This processor is responsible for all real-time processing in the system; the applications are running independent of the PC and its operating system. In addition to the processor there are analog and digital in/outputs, CAN bus interfaces, LIN bus communication, as well as different expansions and options.

All ***ADwin*** applications always run in Real-Time. Every sampled value or event can be evaluated in the same sampling step and e.g. a control function or online analysis can follow immediately, even with high speeds of some kHz, up to some hundred kHz, up to some MHz, depending on the ***ADwin*** hardware. This is guaranteed by the ***ADwin*** system's fast Real-Time response time of 300ns ONLY. Example: After an incoming CAN message, it takes 300 nanoseconds until a Real-Time calculation starts, then it takes just a few microseconds for any online calculation or data acquisition plus analysis, and a reaction can be executed immediately after.

The high performance Real-Time system offers a much higher speed than any of these serial interfaces, which allows very flexible tests.

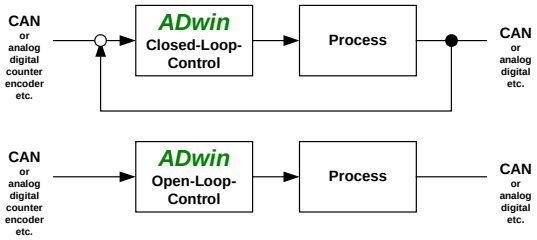
One of the key benefits in the ***ADwin*** PC-communication is, that it is possible to run fast deterministic Real-Time processes AND in the same time to have the communication. Both have no influence on each other, the communication does not disturb the precision of the Real-Time processes, but while running fast processes, it is still possible to run the communication.



The *ADwin* systems are experts to perform jobs in conjunction with CAN bus interfaces, here are just a few of many examples:

- **CAN data acquisition**
  For monitoring and data acquisition applications, the ***ADwin*** systems offer great solutions. So it is possible to acquire messages from a single CAN line, up to 30 different CAN interfaces with full speed of 1Mbit/sec in a single system. Combine analog signals, as well as digital, counter, encoder, etc. in the same application while acquiring the CAN messages. Check boundary curves for all kind of channels, and initiate an alarm if necessary. Perform other jobs on the same system too, e.g. control applications. Use the easy to use and free of charge ADlog, the datalogger software for ***ADwin*** systems.

- **CAN-based Open-Loop-Control & Closed-Loop-Control**
  Either the sensor side, or the actuator, or both sides of the ***ADwin*** as control system can be CAN-based. For instance: ***ADwin*** reads incoming CAN messages, performs any control algorithms, and writes new output values again to a CAN interface.The calculation of the control algorithm starts 300 nanoseconds after the received CAN message, and takes only a few microseconds. So it is easily possible to create fast control loops for many parallel axis.



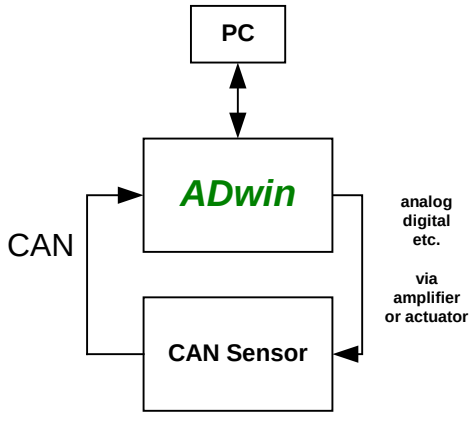
- **CAN sensor tester**
  The ***ADwin*** system checks the CAN sensor with test signals by stimulating the sensor inputs. There are analog or digital test signals, they are generated by the ***ADwin*** system and output directly or via amplifiers or actuators. At the CAN output of the sensor the messages are additionally monitored to find out if the stimulation and the sensor response correspond to the specification.

Specifications

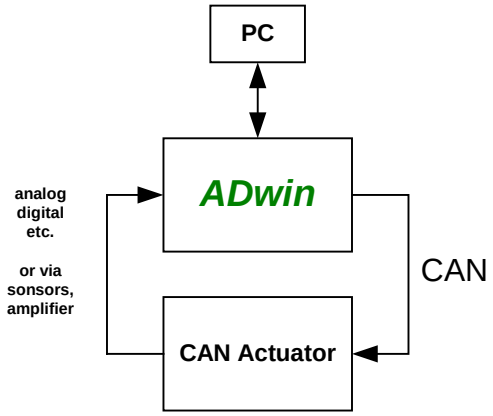
- CAN messaging synchronized with analog, digital, counter, encoder, etc. I/Os
- Automotive CAN-compliant
- ISO 11898-compliant for standard (11-bit) and extended (29-bit) identifier
- 1 and 2-port modules = 1 .. 30 channels per system
- Transfer rates up to 1 Mbit/sec
- Galvanic isolation
- CAN Specification Part A & B
- High-Speed and Low-Speed versions
- Time-stamping of incoming CAN frames, microsecond precision
- Real-Time data processing and response after each frame with maximum performance
- CAN data acquisition, stimulation, and Real-Time control
- CANopen library for specific modules
- Drivers for all Windows systems, Linux, Workstations, etc.
- Drivers for C/C++, Visual Basic 6, Delphi, LabVIEW, LabWindows/CVI, TestPoint, Matlab

Applications

- Intelligent CAN-based data acquisition with online analysis
- CAN-Message bus stimulation
- Open- & Closed-Loop-Controls
- CAN bus monitoring and datalogging via ADlog
- CAN-Sensor tests in R&D and production lines
- Sensor simulation
- CAN Matrix and multiplexer system N-channel to 1 channel
- CAN Gateway
- Mix signal applications, analog, digital, counters, encoders
- CAN applications like automotive testing and diagnostics
- Prototype design
- Factory automation
- Machine control



- **CAN actuator tester**
  In a similar way like CAN sensors, the actuator is tested. The ***ADwin*** system sends CAN messages to the actuator and acquires in the same time with analog and digital inputs the actuator response. So it is possible to perform a real life time test.



- **CAN-based ECU electronic control unit tester**
  The analog and digital outputs of the ***ADwin*** system are programmed to replicate the sensor signals, which are normally connected to the inputs of the ECU. These test signals can be periodic or non-periodic analog or digital waveforms. Recorded values from test drives are possible, too. The ***ADwin*** system drives the ECU inputs while simultaneously monitoring and measuring the responses from the outputs and the CAN, LIN, ... interfaces. The amplitude and timing of the ECU's responses and the messages are evaluated online, allowing different ECU-specific parameters to be extracted and confirmed. The ability to generate all the input signals and monitor the outputs allows an ***ADwin*** system to verify whether an ECU's response conforms to specifications.

- **Intelligent CAN gateway :**
  A gateway is a module which combines different bus systems and structures, with the purpose to exchange data between these bus systems. So an intelligent gateway can connect different, separated CAN systems of a car, as well as CAN to RS-232/485, CAN to LIN, CAN to SPI , etc. Really interesting is the application of an ***ADwin*** system as an intelligent, programmable dynamic gateway; it offers new fields of applications. An ***ADwin*** system connects any number of different bus systems with each other at the same time and permits a unidirectional or bidirectional data exchange. A number of N input channels of the ***ADwin*** Real-Time system is mapped onto the real-time system via any mathematical and logical operations, tables and functions and are output again on a number of M channels in the same sampling process. This procedure can be executed either unidirectional or bidirectional.

- **Intelligent CAN multiplexer and switching matrix :**
  One example is to connect for instance 2..30 separate CAN sensors and control devices to the Real-Time system, to compute mathematically and logically incoming messages, and to output them – depending on the results – as messages on one or more different CAN busses. What is important here, besides the messages of the 2..30 CAN sensors is the timing of how these messages arrive at the real-time system, in other words acquisition of theses messages, accurate to a microsecond. An individual configuration mode for each of the connected systems has been set before the start.

- **Intelligent message stimulation system:**
  The CAN bus in a car reduces the effort for cabling enormously, because several car components and control devices are connected to one BUS. What is an advantage on the one hand can have an adverse effect under some circumstances in critical driving situations, for instance when the data density increases for one reason or another on the CAN bus and some of the data cannot be transferred in the timing required. The ***ADwin*** Real-Time system offers two solutions: ***ADwin*** is working as interference simulator and puts messages to the CAN bus in a perfect timing, and thus simulates failures of defect control devices or defect sensors.