

Data Acquisition and Control Tutorial

PC-based Data Acquisition System Overview

In the last few years, industrial PC I/O interface products have become increasingly reliable, accurate and affordable. Because of this, PC-based data acquisition and control systems are widely used in industrial and laboratory applications like monitoring, control, data acquisition and automated testing.

Selecting and building a DA&C (Data Acquisition and Control) system that actually does what you want it to do requires some knowledge of electrical and computer engineering. This tutorial gives a brief introduction to what DA&C systems do and how to configure them. It covers:

- Transducers and actuators
- Signal conditioning
- Data acquisition and control hardware
- Computer systems software

Transducers and Actuators

A transducer converts temperature, pressure, level, length, position, etc. into voltage, current, frequency, pulses or other signals.

Thermocouples, thermistors and resistance temperature detectors (RTDs) are common transducers for temperature measurement. Other types of transducers include flow sensors, pressure sensors, strain gauges, load cells and LVDTs which measure flow rate, pressure variances, force or displacement.

An actuator is a device that activates process control equipment by using pneumatic, hydraulic or electrical power. For example, a valve actuator opens and closes a valve to control fluid rate.

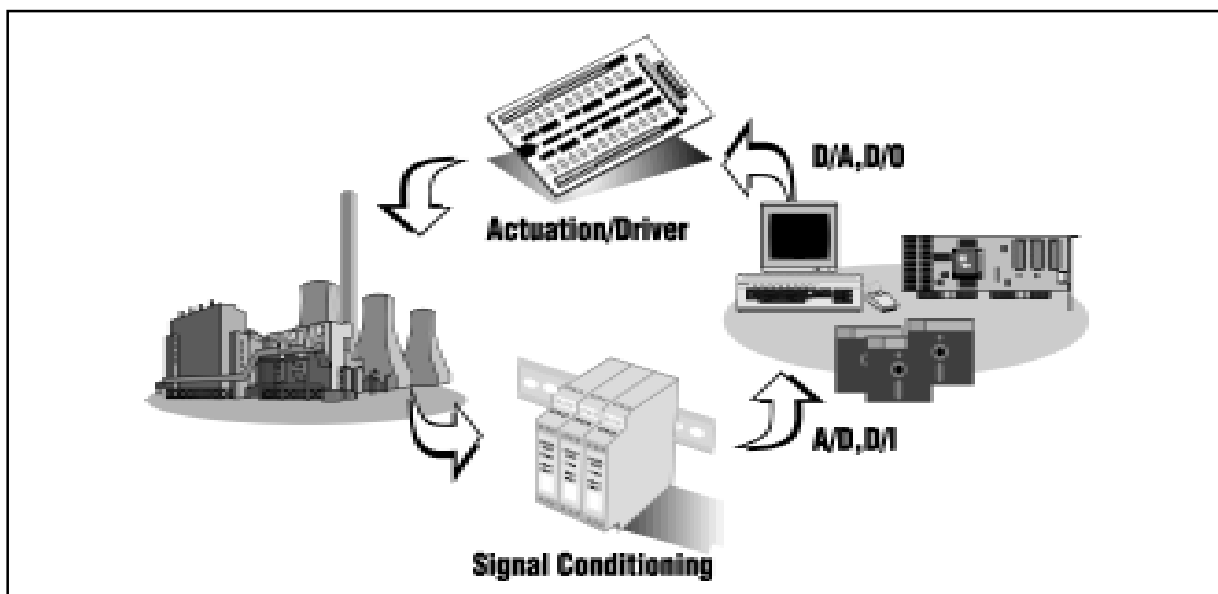
Signal Conditioning

Signal conditioning circuits improve the quality of signals generated by transducers before they are converted into digital signals by the PC's data-acquisition hardware. Examples of signal conditioning are signal scaling, amplification, linearization, cold-junction compensation, filtering, attenuation, excitation, common-mode rejection, and so on.

One of the most common signal conditioning functions is amplification. For maximum resolution, the voltage range of the input signals should be approximately equal to the maximum input range of the A/D converter. Amplification expands the range of the transducer signals so that they match the input range of the A/D converter. For example, a x10 amplifier maps transducer signals which range from 0 to 1 V onto the range 0 to 10 V before they go into the A/D converter.

Data Acquisition & Control Hardware

Data acquisition and control hardware generally performs one or more of the following functions: analog input, analog output, digital input, digital output and counter/timer functions. This section will discuss each function and list some considerations that are important when you select a data acquisition and control system.



The layout of a typical PC-based data acquisition system

