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# DATA COLLECTION IN INTELLIGENT BUILDINGS

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***KEYWORDS:*** *measurement data acquisition, digital/analog converter, sensors*

***Abstract:***

*An overview of automatic computerized measurement procedures, in the case of intelligent buildings. Data collection systems selection in accordance with the featured tasks.*

## 1. Introduction

Nowadays, measurement technique is one of the most widely used in science. In service sector and in the industry, takes more days, to develop and to fix up a measurement procedure. These tasks could be multiple. In classical sense, the measurement is a comparison of measured quantity and the same kind of measurement etalon. In our days, the non-electric quantities are widely measured with electrical transducers. The complexity of the measurements makes more difficult to evaluate measurements result. Development of measurement systems and computers, involved the formation of computer-driven measurement which permits the modern data processing, documentation and automation of measurement processes. In some cases the measurement systems for certain tasks it largely becomes a software problem, especially in the case of intelligent buildings' measured dates.

## 2. Elements of a measuring system:

The measurement system configuration is the following: (1. Figure):
- sensors
- signal conditioner, e.g.: SC-2345
- data acquisition card, e.g.: PCI-6023E
- PC. e.g.: with Windows XP operation system
- DAQ driver software
- evaluation program

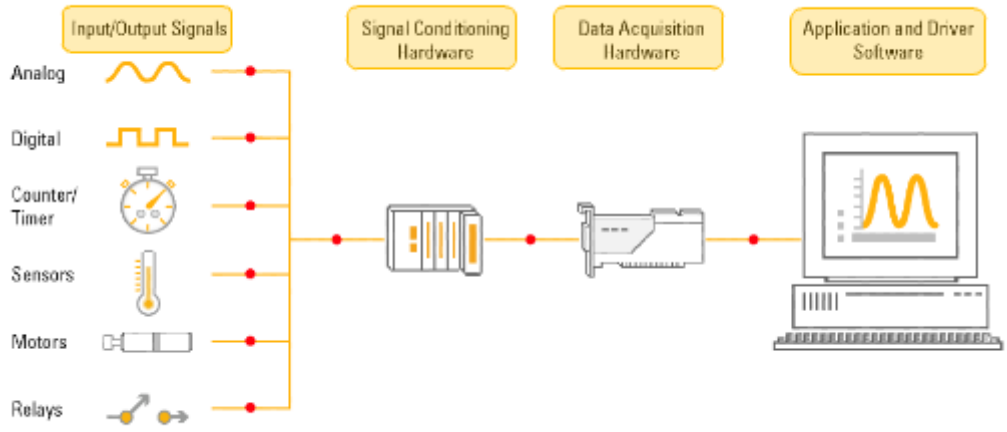



**Figure 1. Data acquisition system (source: www.ni.hu)**

The sensor is in connection with the measured quantities: e.g.: temperature, displacement, rotation, voltage, current, etc. The detected signals from the sensors, usually transforms into voltage, these could be analog or digital values. The output signal of the sensor, get into the signal conditioner, which integrates and converts the incoming signal (amplification, alleviation, filtration, isolation, etc.) for the analog/digital converter (Figure 2).

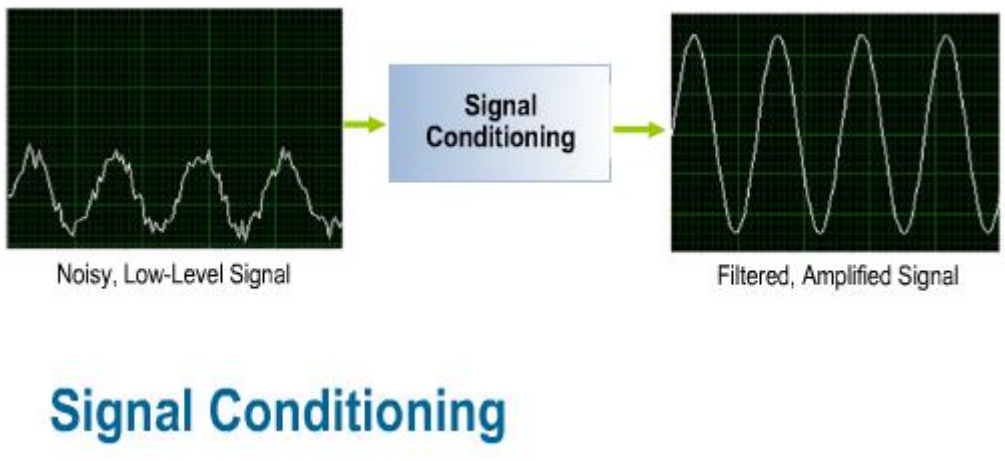



**Figure 2. The noise filtration and strength impact for measured signal (source: www.ni.hu)**

The signal conditioner connects to the data acquisition device. The measurement device performs the needed conversions, temporary storages the dates, and preprocesses the dates. Such an example is the NI 6023E type, measurement card. ([1], Figure 3).

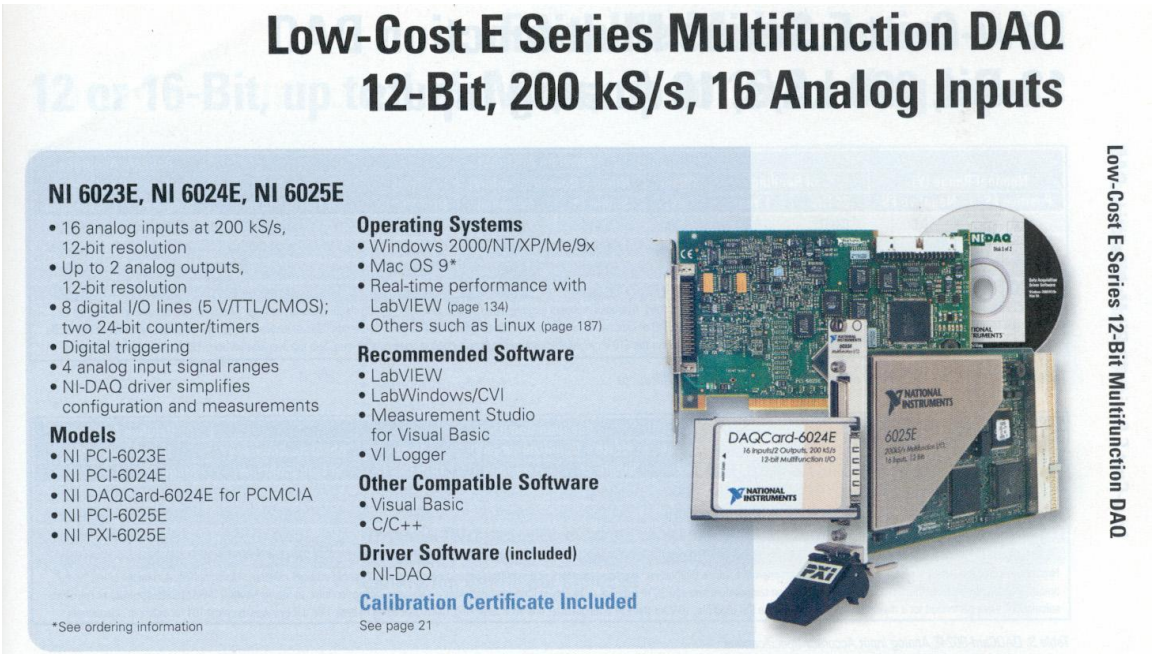



**Figure 3. NI PCI-6023E measurement device (source: www.ni.hu)**

The measurement device is connected to the computer. The needed drivers, applications software are installed in the computer.
One of the best known is LabView developed by NI. This is a high-level graphical programming language [2].The programming is made with the use of graphic icons, and with the connecting wires, thus allowing a process programming (Figure 4). With the programming a virtual instrument comes off, what measures the same way as a real instrument, but a signal analyze and storing also can be carried out.

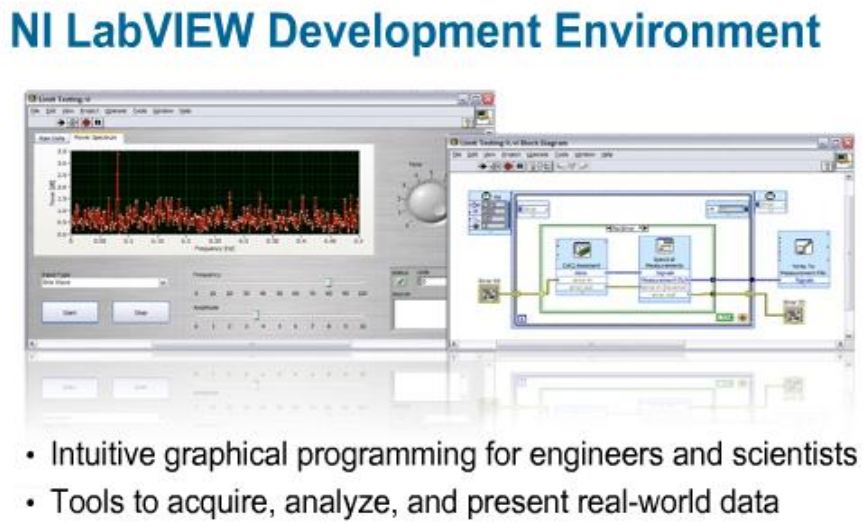


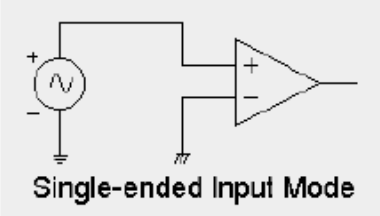

**Figure 4. Front panel and block diagram (source: www.ni.hu)**

## 3.Basic technical parameters, which should be taken into account when we choose a computerized data acquisition device.

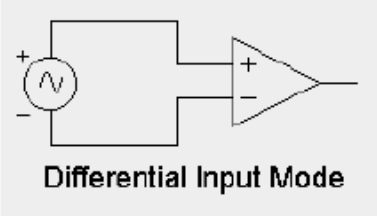
**- Number of input and output channels:**

Number of analog, digital, counter, timer inputs and outputs.

**- Data reading type:**




The measured value of zero potential is the relative absolute difference




The measured value is the two pints difference, relative value

**- Input coupling:**

The method how the input analog signal connects to the input circuit. If the coupling is direct current, then it is able to receive - both the analog alternate current and the direct current – signals if the coupling is AC, then it will allow only the alternate current components to the input and detaches every DC component

**- Input measuring range:**

The maximum and minimum voltage levels, between which the ADC makes the conversion, digitalization of the signal.
The measuring data collector cards' variable measuring borders are tending to the values of +/- 10Vm +/- 5Vm, we give those measurement borders between these ranges with which, at a given resolution, we can the most accurately measure the signal.
The currently used input range looks like this:

$$\text{Current input range} = \frac{\text{input range}}{\text{amplification}}$$

**-The type of the analog/digital converter:**

Different applications require different types of A/D converters in order to achieve the optimal performance. For example, to measure an AC class signal the best A/D converter is one using a delta-sigma modulation. Most A/D converters use one of the following procedures: the so called direct or flash conversion, successive approximation, integration methods, and the delta-sigma method.

**- Amplification:**

The input measuring border of the ADC can be reduced using amplification, ensuring this way that the converter applies the biggest possible digital subdivision for the signal's representation.

**- Resolution, accuracy:**

The number of bits representing the analog signal. The bigger the resolution, the measuring range can be divided to more segments, and so the detectable smallest voltage fluctuation is refined. The smallest detectable voltage fluctuation in an ideal A/D converter is the following:

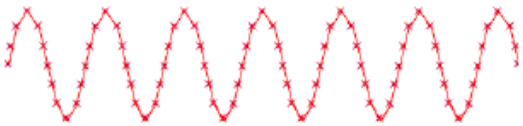
$$\text{Smallest detectable voltage fluctuation} = \frac{\text{measuring range}}{\text{amplification} * 2^{\text{resolution}}}$$

An A/D converter's resolution is only one of the existing parameters, which is not enough to determine the quality of the converter. Important parameters are also the linearity, settling time, offset error and amplification error. All these parameters together determine the converter's goodness.

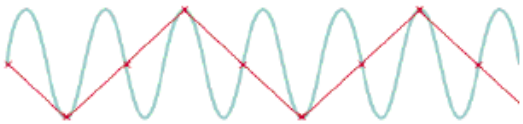
**- Sampling rate, sampling frequency:**

The highest sampling rate is the one with which the input is able to digitalize the input analog signal. We note here, that when measuring fast changing signals we must also take in consideration the applied amplifier's alternating current's characteristics in the analog-digital converter.

good sampling signal



bad sampling signal



**4. Conclusion:**

Measurement systems development -which is intended to measure different quantities- through the general measuring systems, points to the automatic measuring systems. Computer controlled data acquisition system, and the Labview graphical programming language developed by the National Instruments company, performs the entire data acquisition tasks related to intelligent buildings.

## Acknowledgement

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## References:

[1] National Instruments PCI-6023E adatgyűjtő kártya Data Sheet
[2] National Instruments LabVIEW felhasználói kézikönyv