

# **PC-BASED DATA ACQUISITION SYSTEM**

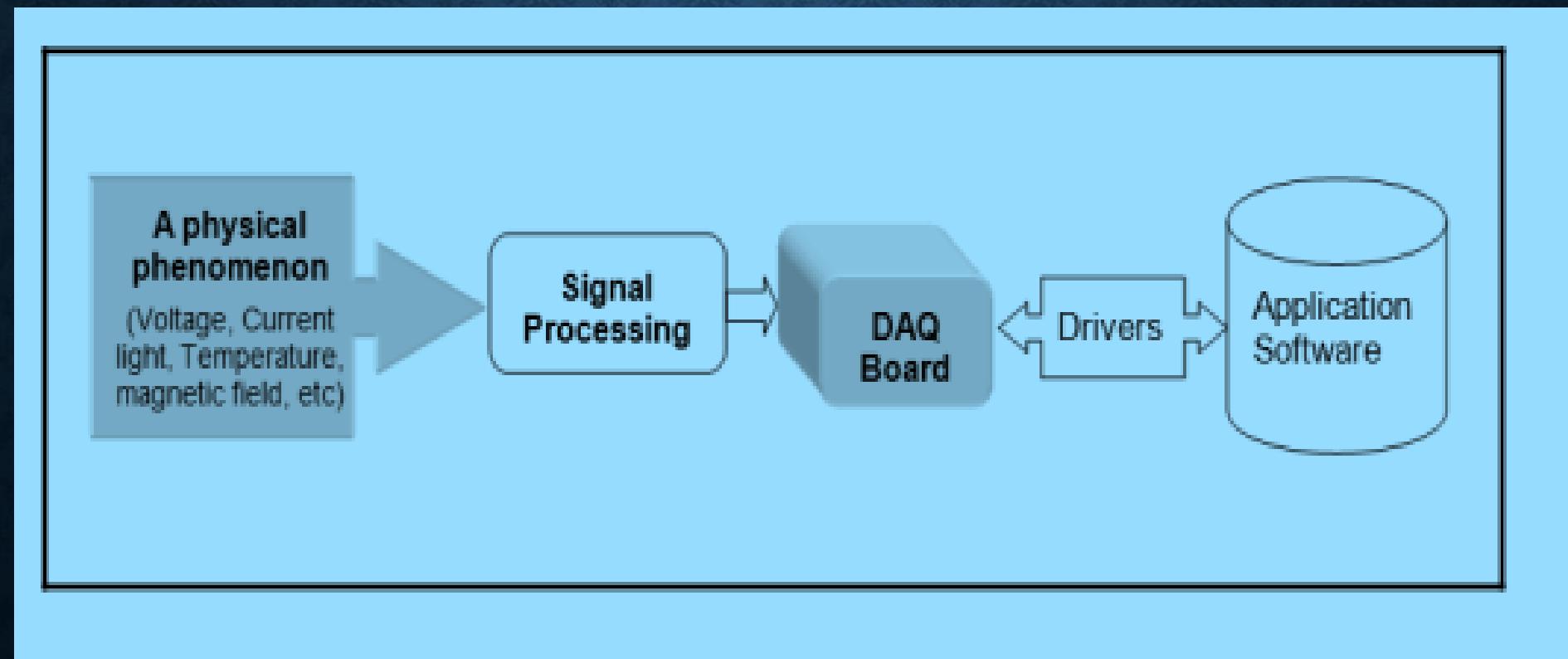
LabVIEW based data acquisition

# PC-BASED DATA ACQUISITION SYSTEM

- With a Personal Computer (PC) a **general-purpose computer**, as these are easy to expand with more memory, and more I/O ports etc.
- A PC is designed to be able to run all kind of application programs that you can buy or intend to develop.
- A general purpose computer need to be ready for new device drivers and software to run hardware it doesn't know about yet, like new printers or hard drives, and it need to run different application programs.
- The PC usually need to run several programs at the same time on the CPU by sharing CPU time between the different applications (multitasking), or by running different applications in parallel on different CPUs or different CPU cores.
- The typical PC today have two or four CPU cores, but can have up to 20 cores with ten CPU cores on two CPUs

# DEFINITION OF DATA ACQUISITION

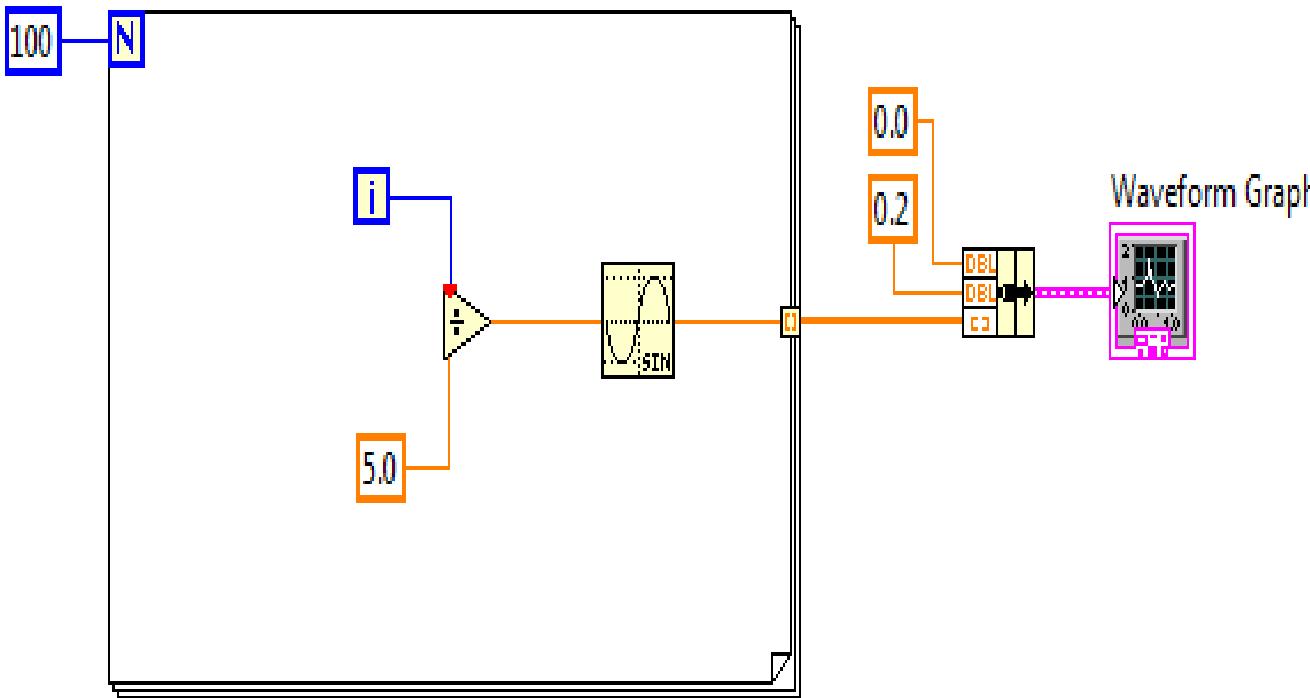
Data acquisition is the process of converting a real-life physical occurrence or phenomenon into computer-understandable data .



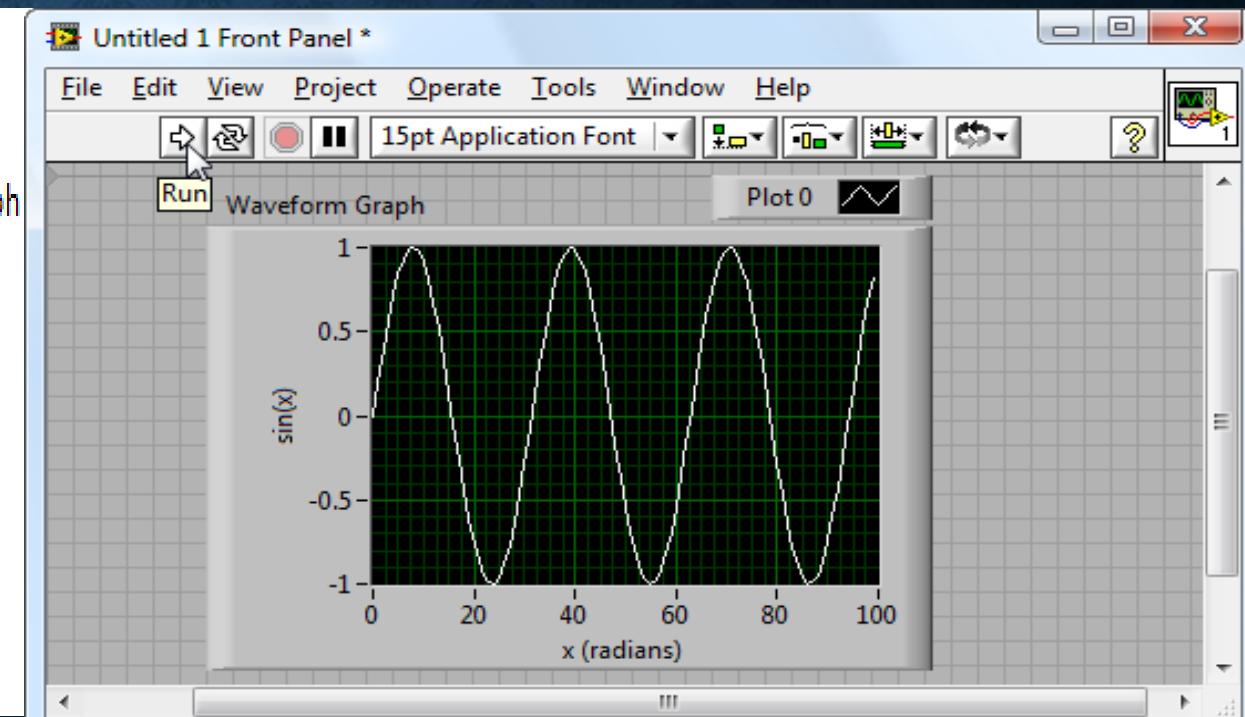
# ADVANTAGES OF LABVIEW SYSTEM

- LabVIEW Programming Language is Graphical

Block Diagram (Program Code):

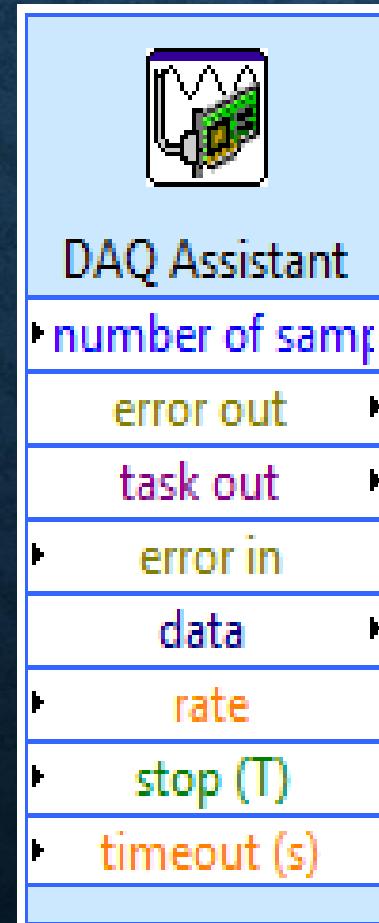


Front Panel (User Interface):



# CONTD..

- Express VIs for Streamlined Programming of Common Tasks



**Measuring Voltage**

Most measurement devices are designed for measuring, or reading, voltage. Two common [voltage measurements](#) are DC and AC.

DC voltages are useful for measuring phenomena that change slowly with time, such as temperature, pressure, or strain.

AC voltages, on the other hand, are waveforms that constantly increase, decrease, and reverse polarity. Most powerlines deliver AC voltage.

This displays the analog samples acquired or generated by the device.

OK Cancel

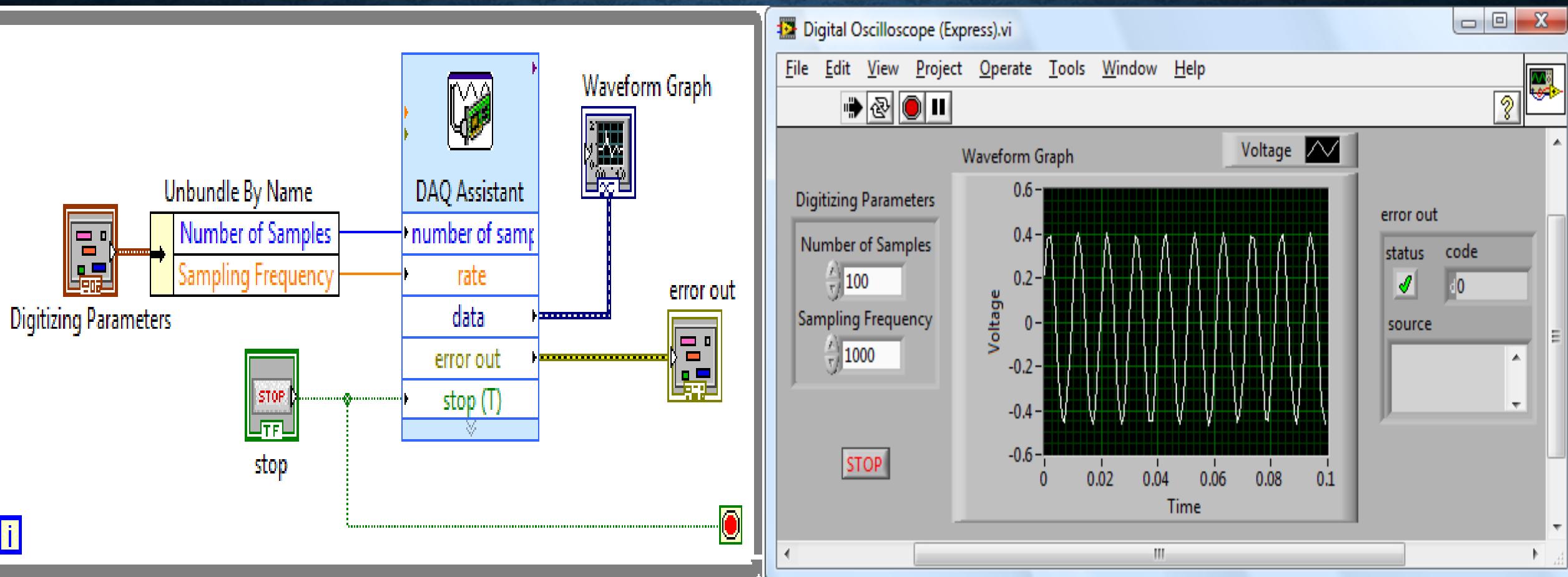
# OVERVIEW AND CONFIGURATION

Fundamental task of a DAQ system is to measure or generate real-world physical signals

DAQ system consists of:

- Transducers
- Signal Conditioning
- Plug-in DAQ device
- Driver
- Software

# DIGITAL OSCILLOSCOPE USING DAQ ASSISTANT EXPRESS VI



# MEASUREMENT SOFTWARE FRAMEWORK

- NI-DAQ contains:
- Traditional NI-DAQ
- NI-DAQmx



# DATA ACQUISITION IN LABVIEW

## Traditional NI-DAQ

Specific VIs for performing:

- Analog Input
- Analog Output
- Digital I/O
- Counter operations



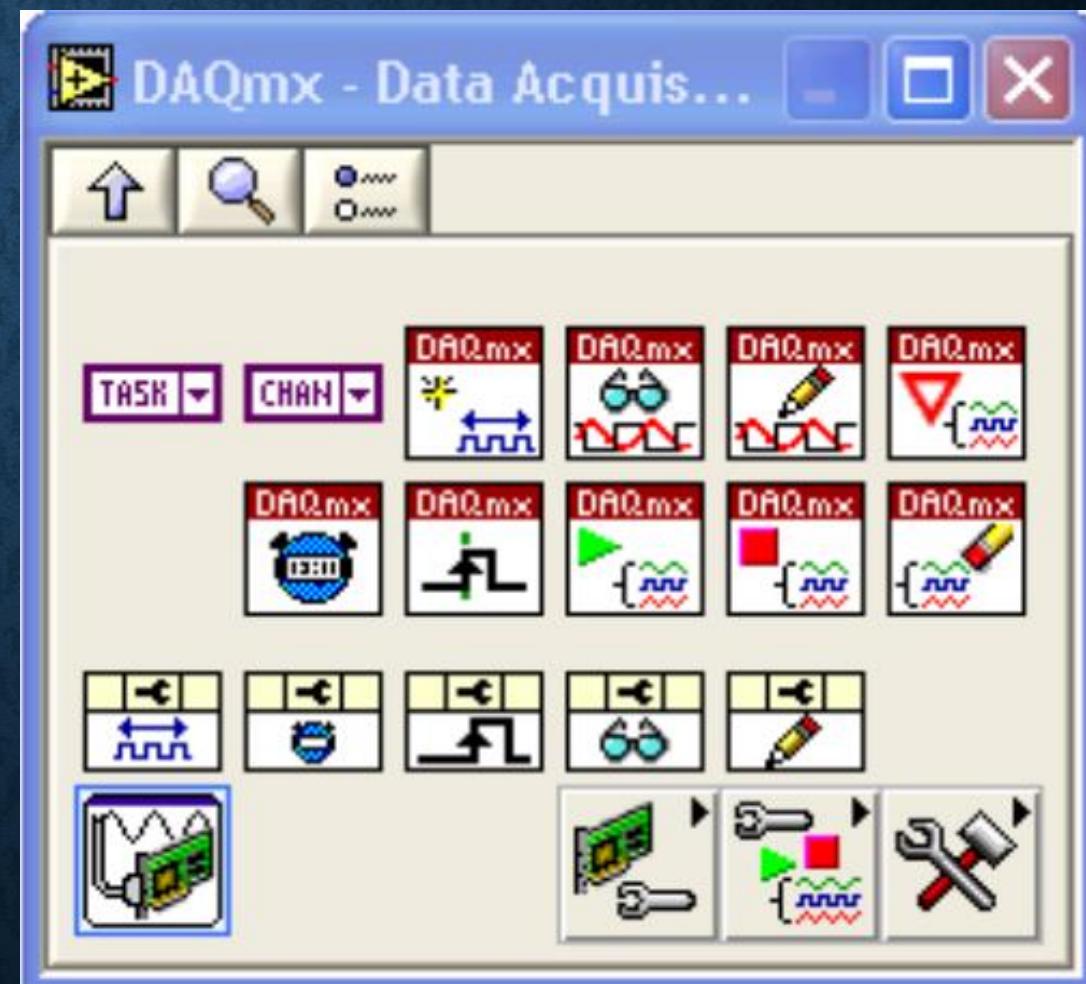
## NI-DAQmx

Next generation driver:

- VIs for performing a task
- One set of VIs for all measurement types

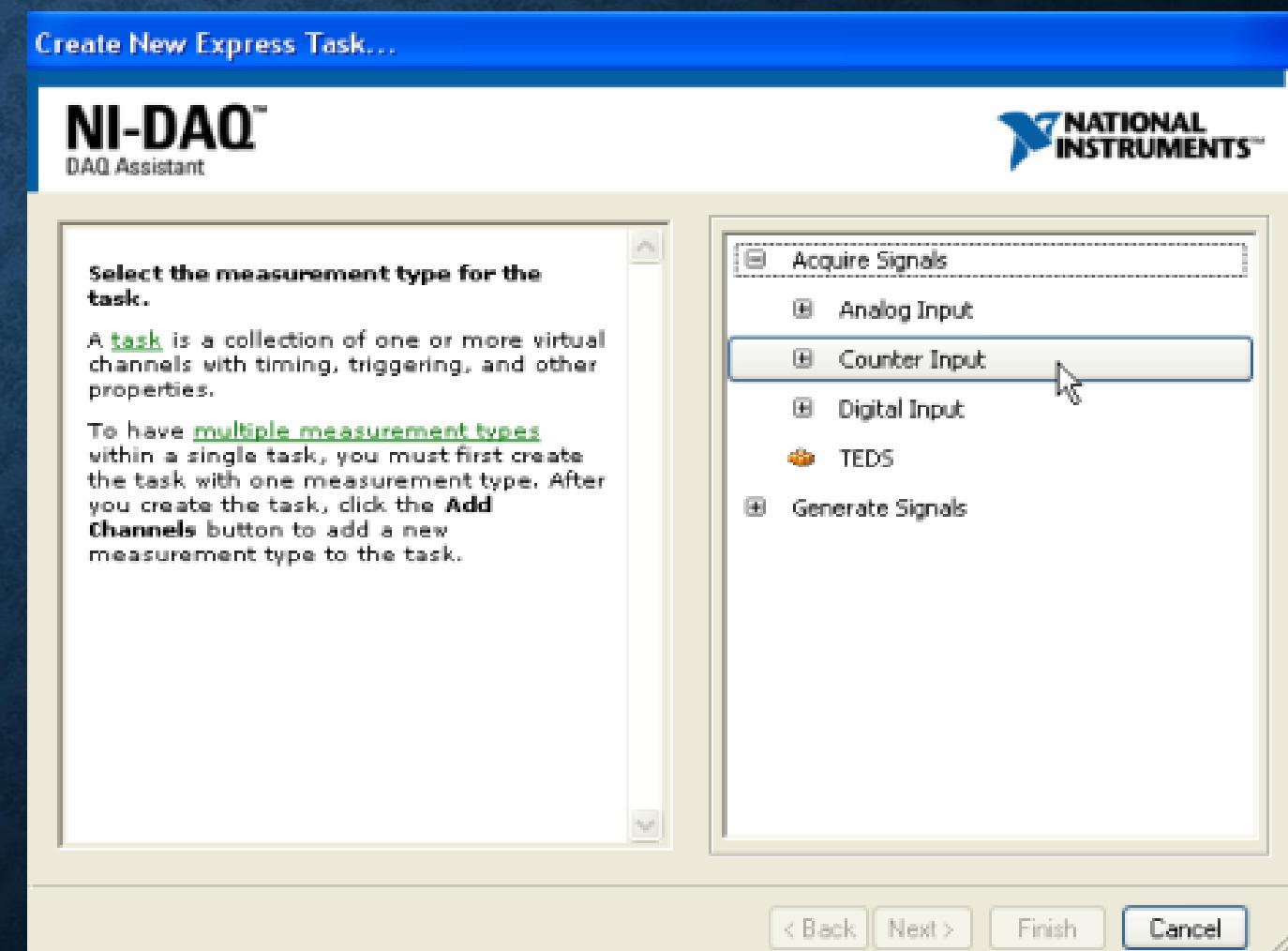
# NI-DAQMX DATA ACQUISITION

- Single set of VIs used to perform analog I/O, digital I/O, and counter operations
- **DAQ Assistant Express VI**
- Quickly and easily program the DAQ device
- Creates a local task
- Most applications can use the DAQ Assistant Express VI



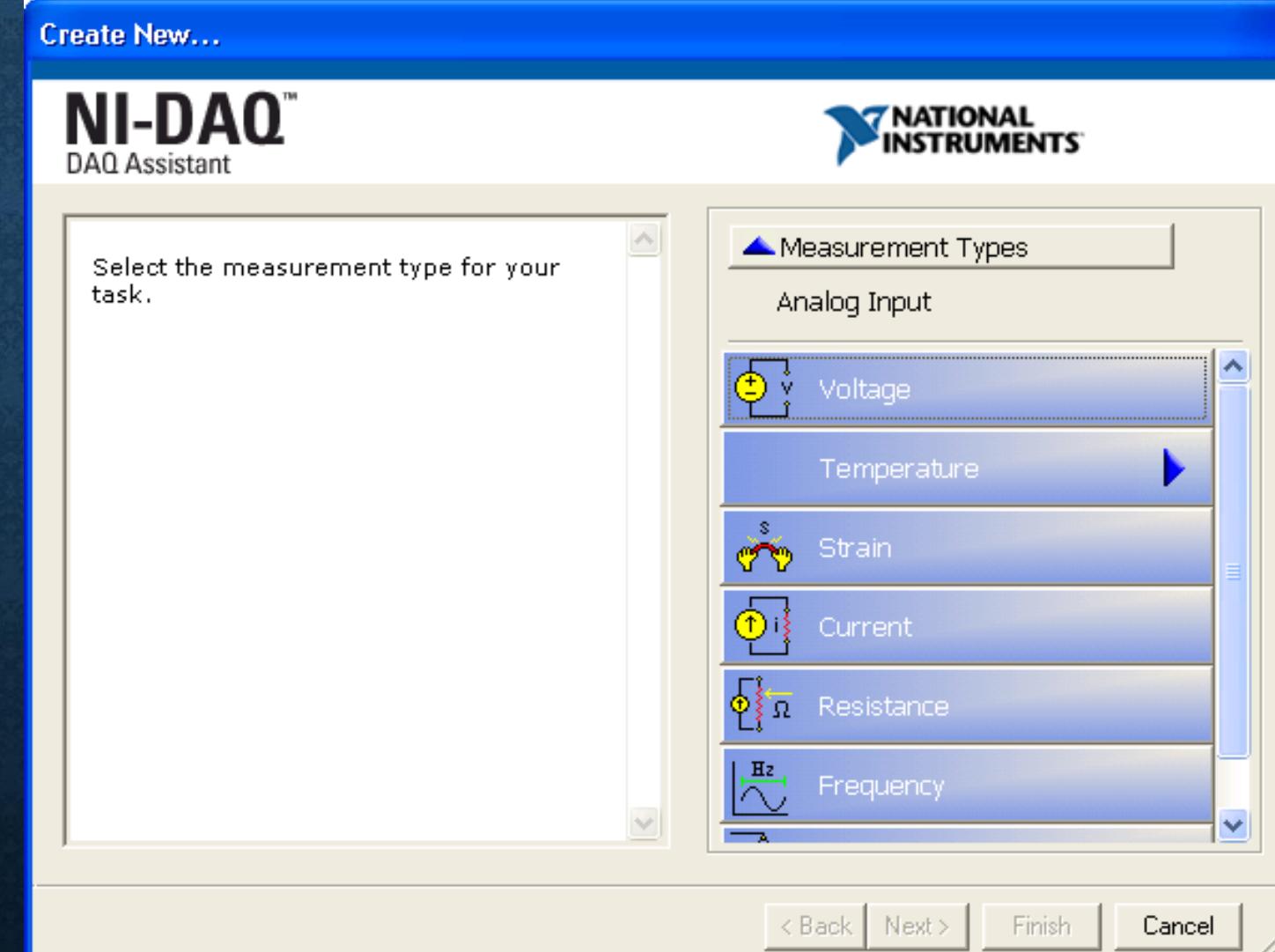
# NI-DAQMX DATA ACQUISITION TASK TYPES

- Measurement type can be:
- Analog Input
- Analog Output
- Counter Input
- Counter Output
- Digital I/O



# ANALOG INPUT

- Analog Input task is specific to the measurement



# ANALOG INPUT TASK TIMING AND TRIGGERING

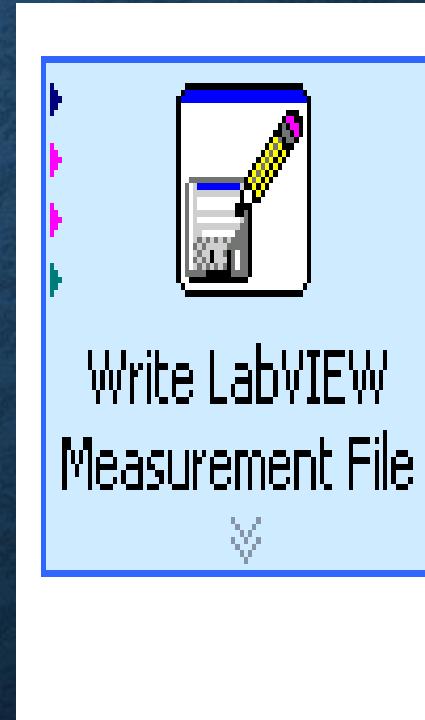
- Configures the number of samples and sample rate for the task
- Configures the start and reference triggers for the task

The image shows two configuration panels from LabVIEW:

- Task Timing:** This panel is used to set the acquisition mode, number of samples, and sample rate.
  - Acquisition Mode:** Radio buttons for "Acquire 1 Sample", "Acquire N Samples" (selected), and "Acquire Continuously".
  - Samples To Read:** Text input field containing "100".
  - Rate (Hz):** Text input field containing "1000.00".
- Task Triggering:** This panel is used to configure the trigger types for the task.
  - Start:** A green icon with a black 'L' shape. Trigger Type dropdown menu: <none>.
  - Reference:** A red icon with a black 'L' shape. Trigger Type dropdown menu: <none>.

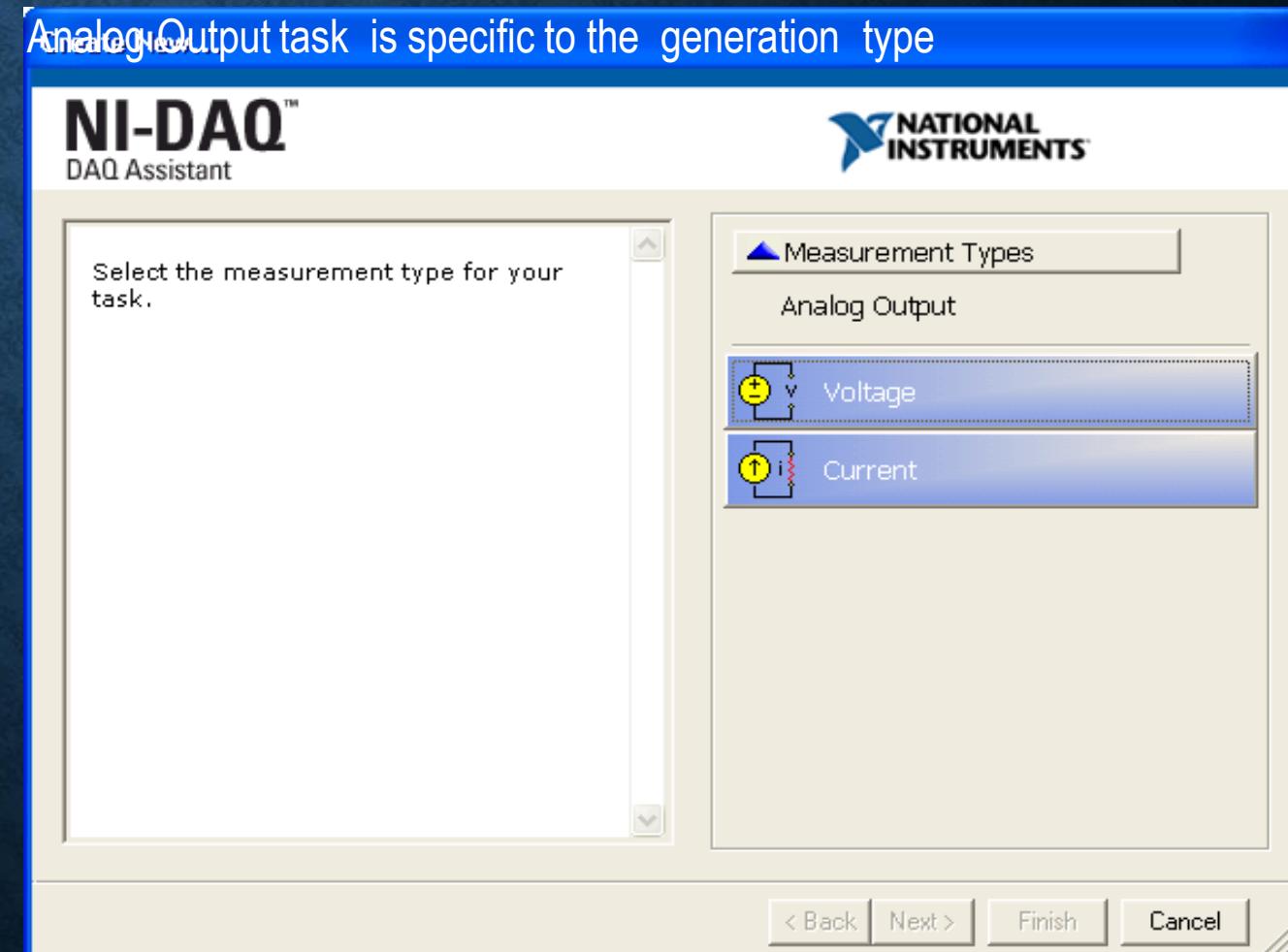
# DATA LOGGING

- It is often necessary to permanently store data that is acquired from the DAQ device
- LabVIEW includes the ability to read and write a LabVIEW Measurement File.
- LabVIEW Measurement File is an ASCII text file.



# ANALOG OUTPUT

- Analog Output task is specific to the generation type



# COUNTERS

- A counter is a digital timing device

Typical uses of a counter:

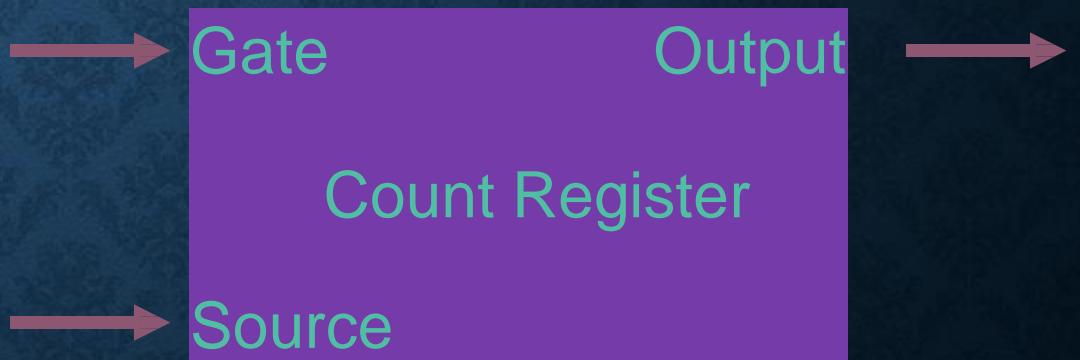
- Event counting
- Frequency measurement
- Period measurement
- Position measurement
- Pulse generation

**Count register** – Stores the current count of the counter

**Source** – Input that causes the counter to increment each time it toggles

**Gate** – Input that is used to enable or disable the function of the counter

**Output** – Signal that generates pulses or a series of pulses

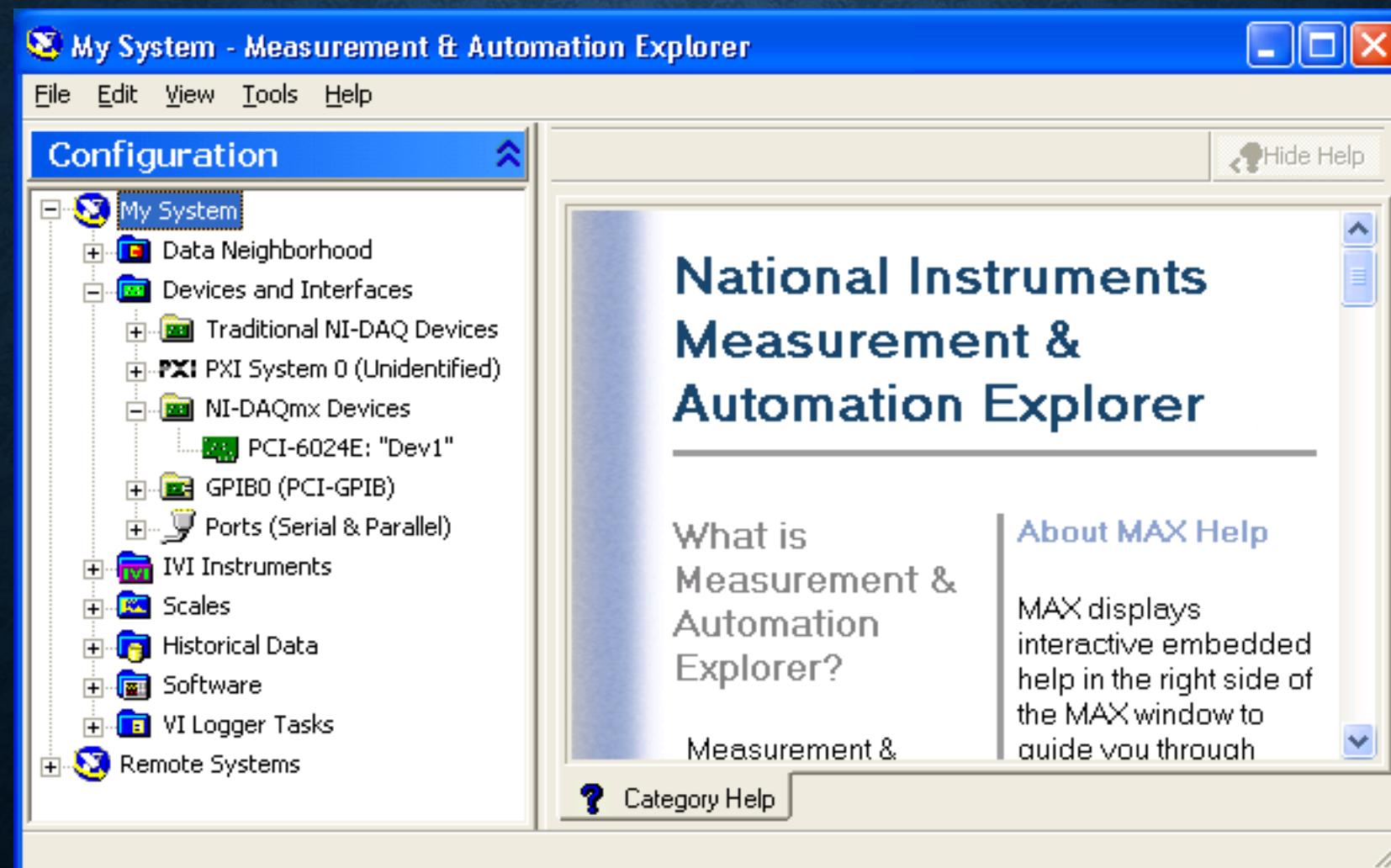


# DIGITAL INPUT AND OUTPUT

- Digital I/O can read from or write to a line or an entire digital port.
- A digital port is a collection of digital lines



# DAQ HARDWARE CONFIGURATION



# NI USB-6009

- **Analog input (AI):** 8 inputs with referenced single ended signal coupling or 4 inputs with differential signal coupling.
- Software-configurable voltage ranges:  $\pm 20V$ ,  $\pm 10V$ ,  $\pm 5V$ ,  $\pm 4V$ ,  $\pm 2.5V$ ,  $\pm 2V$ ,  $\pm 1.25V$ ,  $\pm 1V$ . Max sampling rate is 48kS/s (48000 samples per second).
- 14 bits AD converter
- **Analog output (AO):** 2 outputs. Voltage range is 0 - 5V (fixed).
- Output rate is 150Hz (samples/second). 12 bits DA converter.
- **Digital input (DI) and digital output (DO):** 12 channels which can be used as either DI or DO (configured individually).
- **Counter:** 32 bits. Counting on falling edge.
- **On-board voltage sources** (available at individual terminals): 2.5V and 5.0V
- **Power:** USB-6009 is powered via the USB cable.

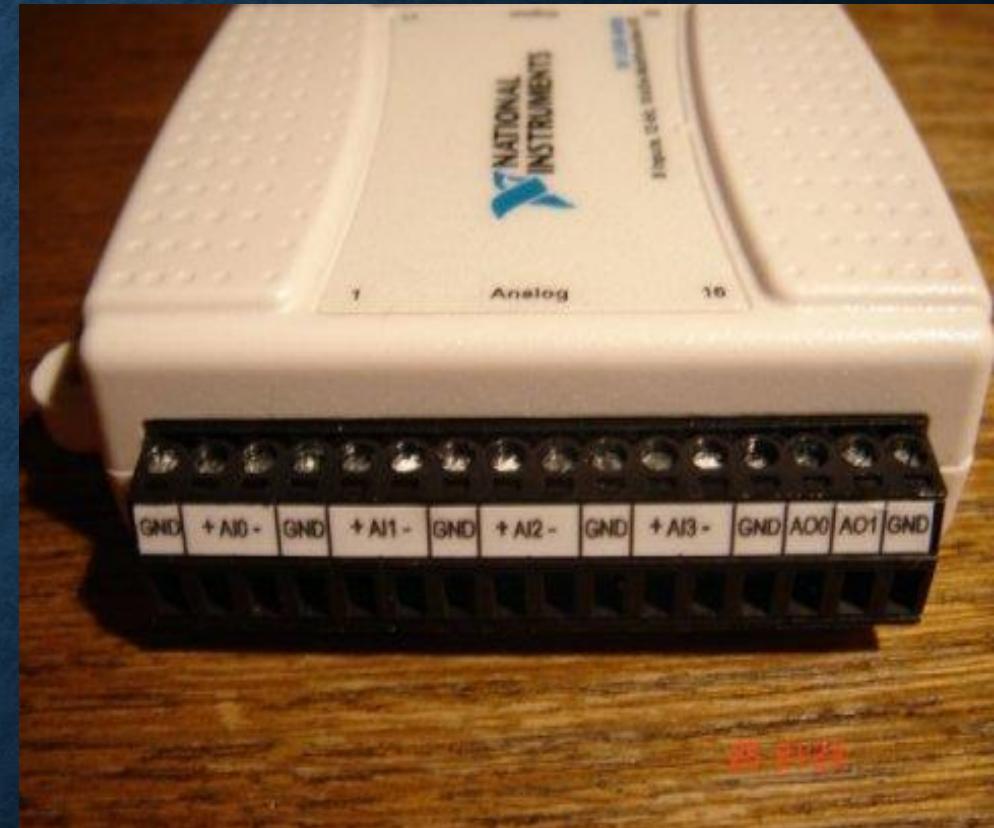


Figure: NI USB-6009

# NI USB-6008

- NI USB-6008 is a simple and low-cost multifunction I/O device from National Instruments.
- The device has the following specifications:
- 8 analog inputs (12-bit, 10 kS/s)
- 2 analog outputs (12-bit, 150 S/s)
- 12 digital I/O USB connection
- No extra power-supply needed
- Compatible with LabVIEW, Lab Windows, and Measurement Studio for Visual Studio .NET
- NI-DAQmx driver software



Figure: NI USB-6008

