

Data Acquisition Hardware



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Types of DAQ Hardware

- ADC - Analogue to Digital Conversion (input)
- DAC - Digital to Analogue Conversion (output)
- DI, DO - Digital Input or Output
- Counter - Count or Generate trains of pulses, Measure delays between pulses
- Digitizer - High speed (GS/s) ADC
- Interface - GPIB, RS232 (serial), USB, IEEE1394 (Firewire) etc



The ADC in Detail

- Sampling Rate (kS/s or MS/s)
- Resolution (Number of Bits {8 – 24})
- Input Range (voltage span and offset)
- Architecture of card
 - Number of Channels
 - Sequential or Simultaneous sampling
 - Conversion speed
 - Routing of Clocks and/or Triggers



DAQ Clocks and Triggers

- Can use Internal or External clock to read/write samples (don't exceed max rate)
- External clock useful to synchronise with other equipment/hardware
- External trigger useful for non-periodic or 'random' events
- Can combine both external Trigger and Clock, along with Counter and DIO



ADC Connections I

Input	Signal Source Type	
	Floating Signal Source (Not Connected to Building Ground)	Grounded Signal Source
	Examples <ul style="list-style-type: none"> • Ungrounded Thermocouples • Signal conditioning with isolated outputs • Battery devices 	Examples <ul style="list-style-type: none"> • Plug-in instruments with nonisolated outputs
Differential (DIFF)	<p>See text for information on bias resistors.</p>	
Single-Ended — Ground Referenced (RSE)		<p>NOT RECOMMENDED</p> <p>Ground-loop losses, V_g, are added to measured signal</p>
Single-Ended — Nonreferenced (NRSE)	<p>See text for information on bias resistors.</p>	

From any of the NI manuals for DAQ devices



ADC Connections II

- Use Differential (DIFF) connections when
 - Measuring low-voltage ($<1V$)
 - In an electrically noisy environment
 - If connected using long cables ($>3m$)
 - Input signal requires separate Ground reference
- Each differential channel requires two ADC channels!



ADC Connections III

- Use Referenced Single-Ended (RSE) connections when
 - The input signal level is high ($>1V$)
 - If connected using short cables ($<3m$)
 - Input signal can share reference point with other signals
- Beware of connecting to devices that share a Ground with the DAQ system!



ADC Connections IV

- Use Non-Referenced Single-Ended (NRSE) connections when
 - The input signal level is high ($>1V$)
 - If connected using short cables ($<3m$)
 - Input signal can share reference point with other signals
- Use NRSE when connecting to device sharing a Ground with DAQ system (use AISense terminal as reference)



Synchronising Multiple DAQ Cards

- Can synchronise PCI cards using RTSI cable
- Synchronise PXI cards using backplane busses
- eg: One card can distribute its DAQ clock to other devices. A second card could receive an external trigger and send this to the first card



Non NI DAQ Hardware

- Many other suppliers of DAQ hardware
- Often designed for their own sensors/actuators
- Often supplied with LabVIEW library
- If it conforms to a standard (PCI, PXI, USB etc) then it should be compatible with any other hardware

