

# Data Acquisition Essentials

*For Cardiovascular Research Applications*

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## PowerLab Data Acquisition System

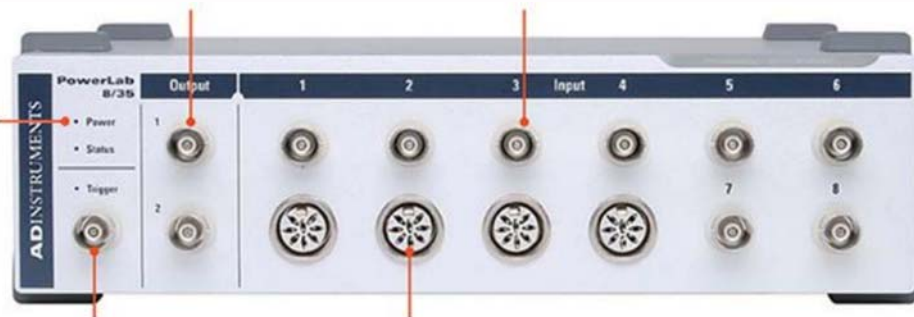
- /// Software controlled data recording and online or offline analysis system
- /// Consists of fully integrated hardware and software
- /// Records any analog voltage signal of  $\pm 10$  V
- /// Interfaces with Macintosh & PC via fast USB
- /// Performs many functions including
  - /// Slow continuous recording
  - /// Fast transient recording
  - /// Stimulation
  - /// Triggering



# Basics of Data Acquisition

Analog Output    Analog input BNC Connector

Power Indicator



Trigger Input

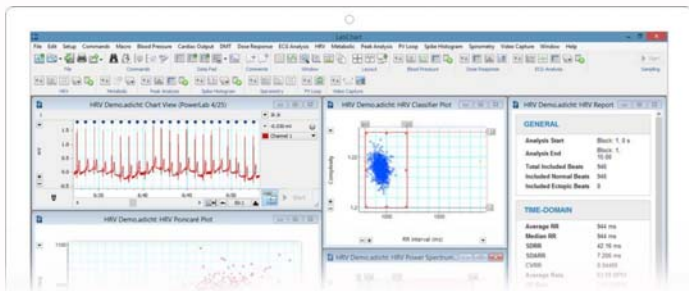
Analog input DIN Connector

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# Basics of Data Acquisition

- Sampling Rates
- Filtering
- Digitization
- Range
- Noise

# LabChart®

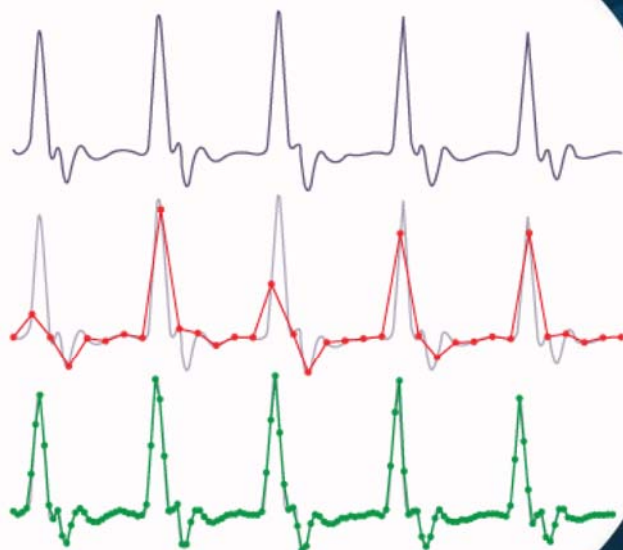


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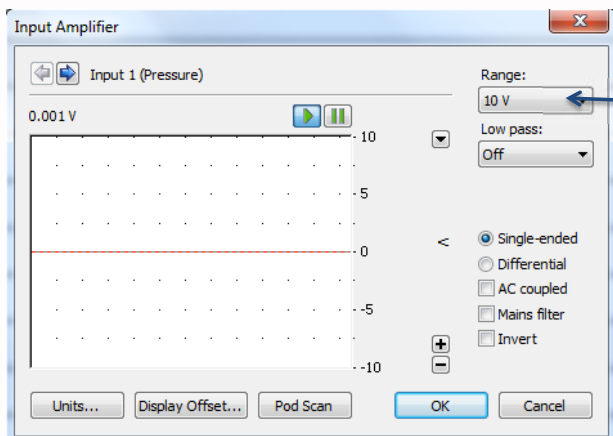


# Sampling Rates

- Too Low
  - Information is Lost
  - Signal not represented correctly
- Too High
  - No information Loss
  - Increased file size and processing time
- Optimal Sampling Rate
  - Nyquist Frequency is the minimum
  - 5-10 times the highest expected frequency is recommended



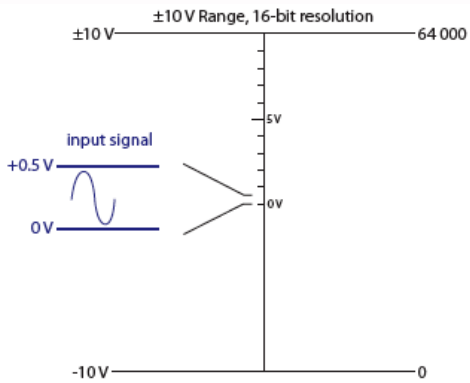
# Range or Amplification



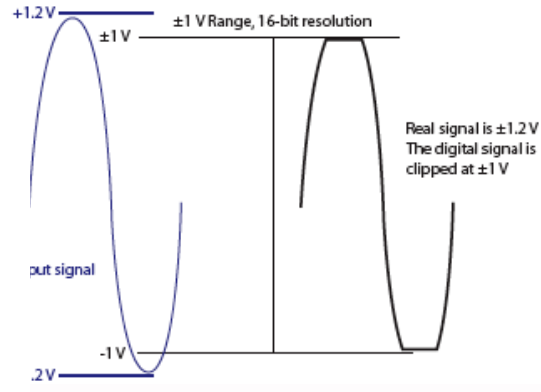
Amplification

# Range

Range is the amplitude expected for recording



## ± 2 mV to ±10 V in 12 Steps

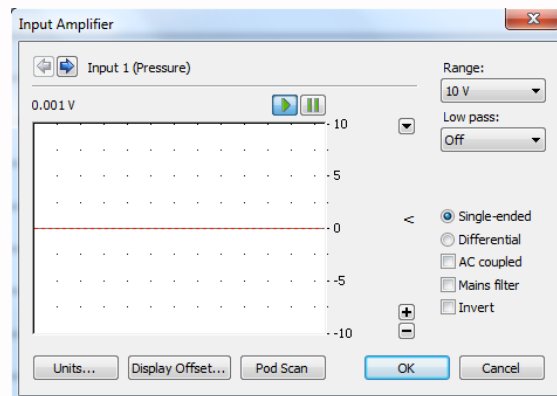


If the signal is larger than the range, the top/bottom is 'clipped' and max/min values are lost.

A small signal on a large range will have a poor resolution as only a small part of the range is used.

# Hardware Filters

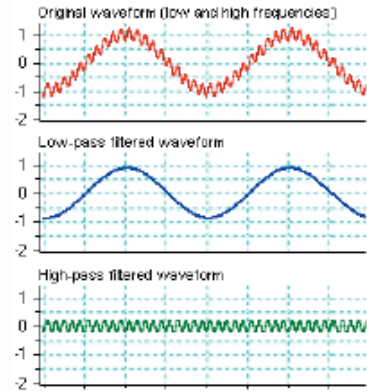
- Mains Filter
  - Smart filter for Mains Noise
- AC Coupling
  - High Pass Filter of 0.1Hz for offset adjustment
- Low Pass Filtering





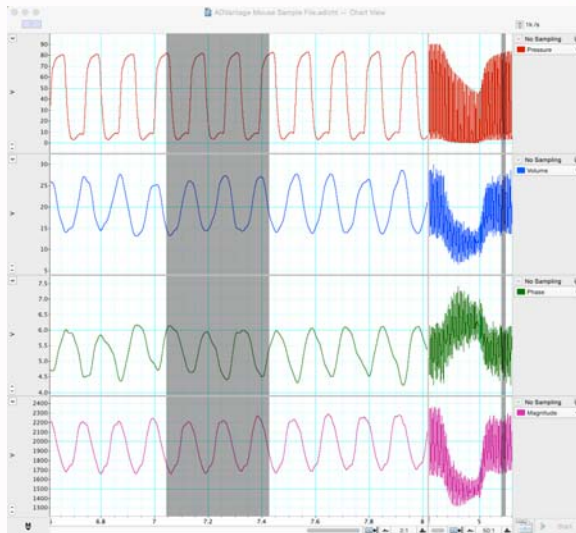
# Hardware Filters

- /// Mains Filter
  - Smart filter for Mains Noise
- /// Low Pass
  - Lets low frequencies pass
  - Reduce “noise”
  - Smooth Signal
- /// High Pass
  - Removes offset
  - Lets high frequencies pass



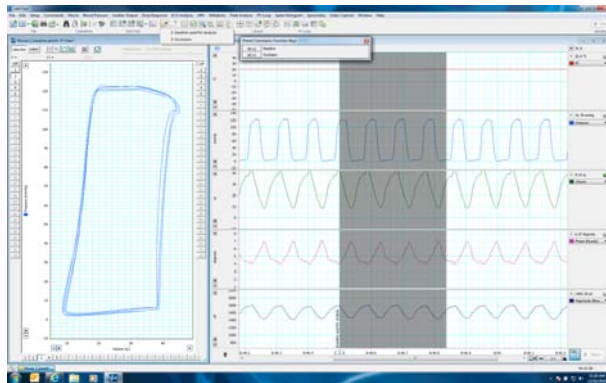
# Scaling and Viewing Data

- /// Scaling
- /// DVMs
  - Display Current Value in Channel
- /// X Axis Scrolling
- /// Split View
- /// Zoom View
- /// Layouts



# Comments

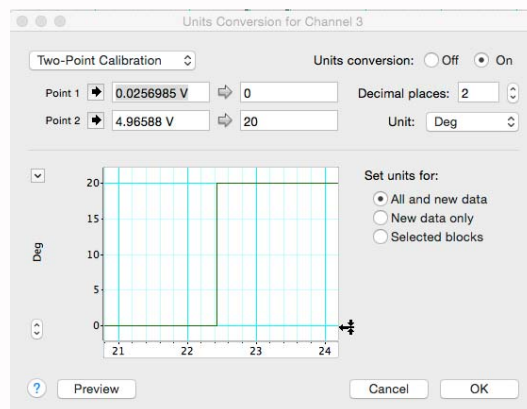
- Adding Comments Live
- Adding Comments Post Acquisition
- Preset Comments
- Using Comments
  - Comment List
  - Comment Window
  - Editing Comments



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# Calibration using Units Conversion

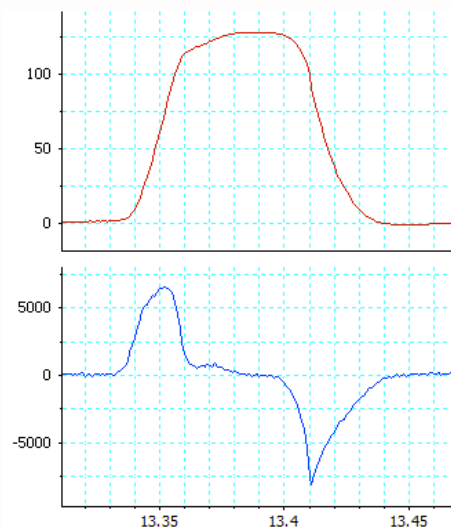
- Converts Voltage Values to meaningful units
  - PV System
    - Pressure
    - Volume
    - Phase
  - Flowmeter
    - Flow



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# Online Monitoring of PV, Pressure and Flow

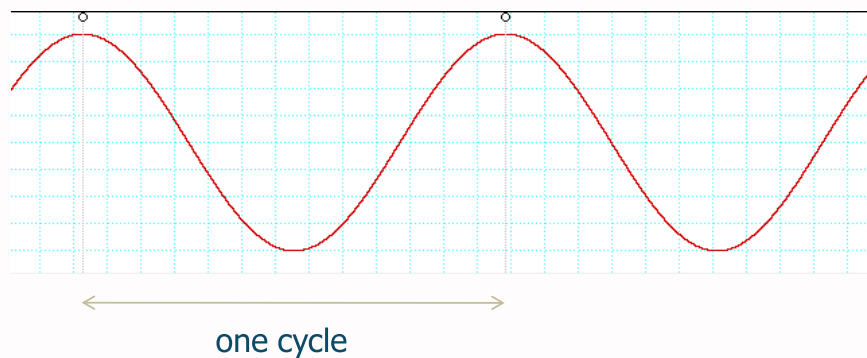
- Pressure
  - Cyclic Measurements
    - SBP
    - DBP
    - dP/dt
  - Derivative (dP/dt)
- Blood Flow
  - Smoothing
  - Integral
  - Cyclic Measurements
- PV
  - XY View



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## Cyclic Measurements

- Cyclic measurements is a Channel Calculation
- Calculates a cyclic value between pairs of events

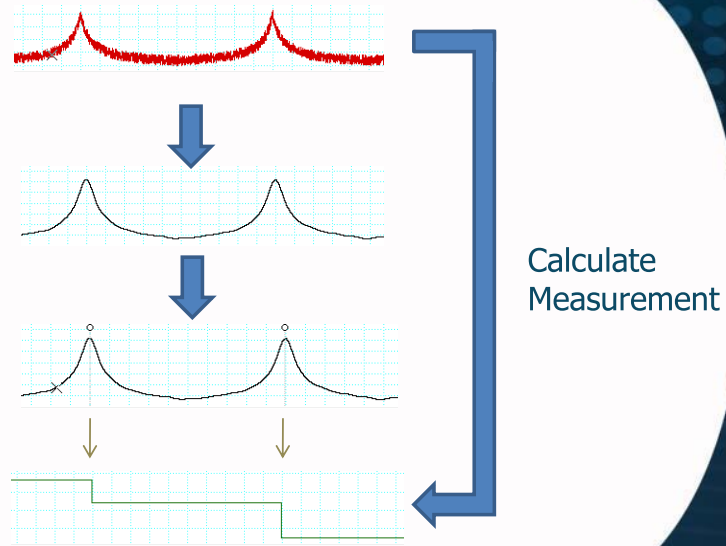


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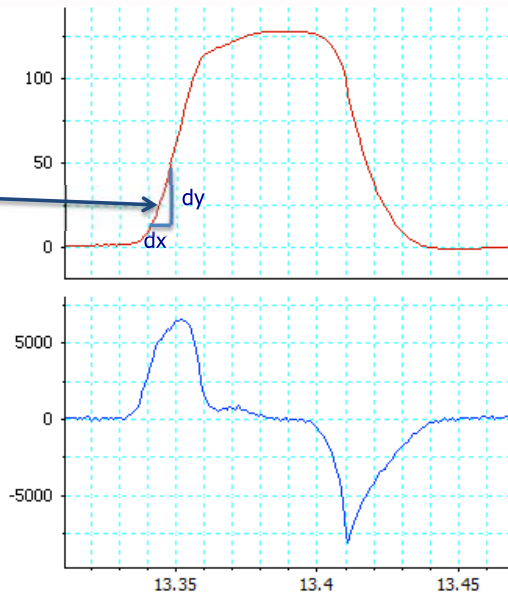
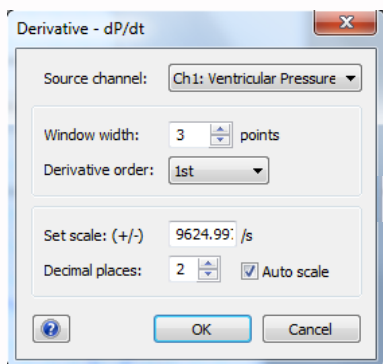
# Cyclic Measurements

Basic steps:



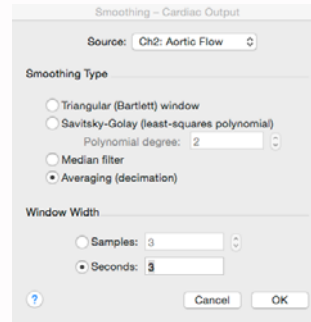
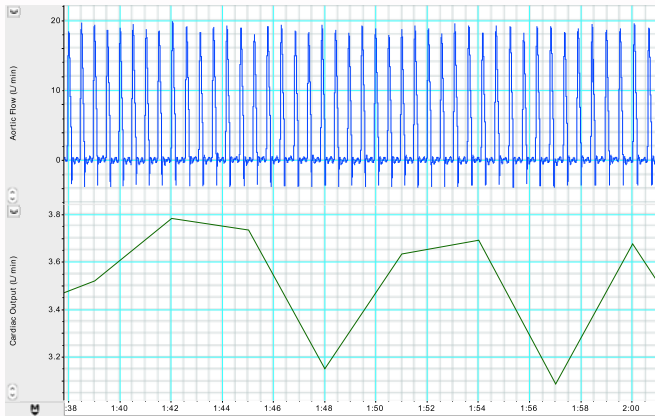
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# Derivative for dP/dt

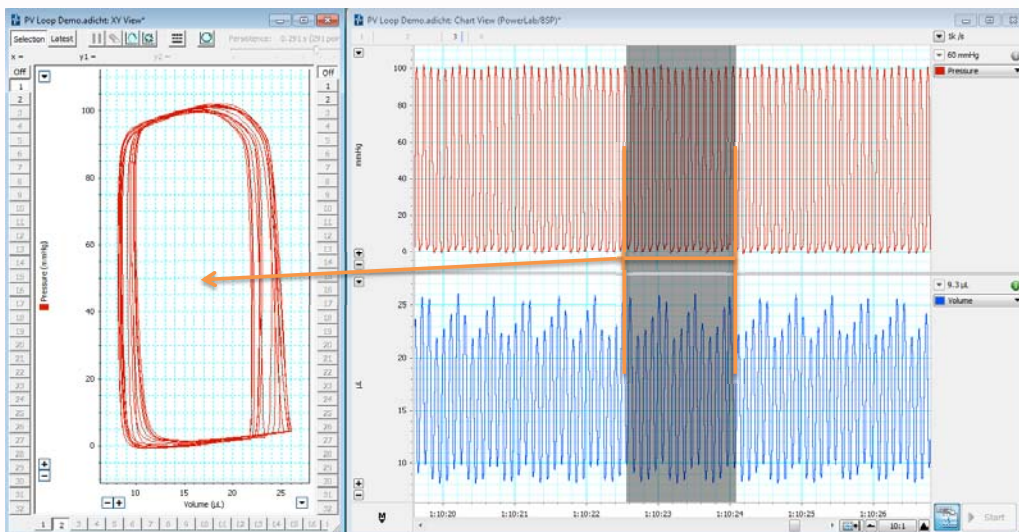


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# Smoothing Blood Flow for CO



# Online PV Loop Monitoring



# Settings Files

## Settings Files

- Save all settings and configurations we have talked about today
- Allows a template file to be created to start experiments
- All hardware settings (ADI Hardware) is saved and set in motion without setup

